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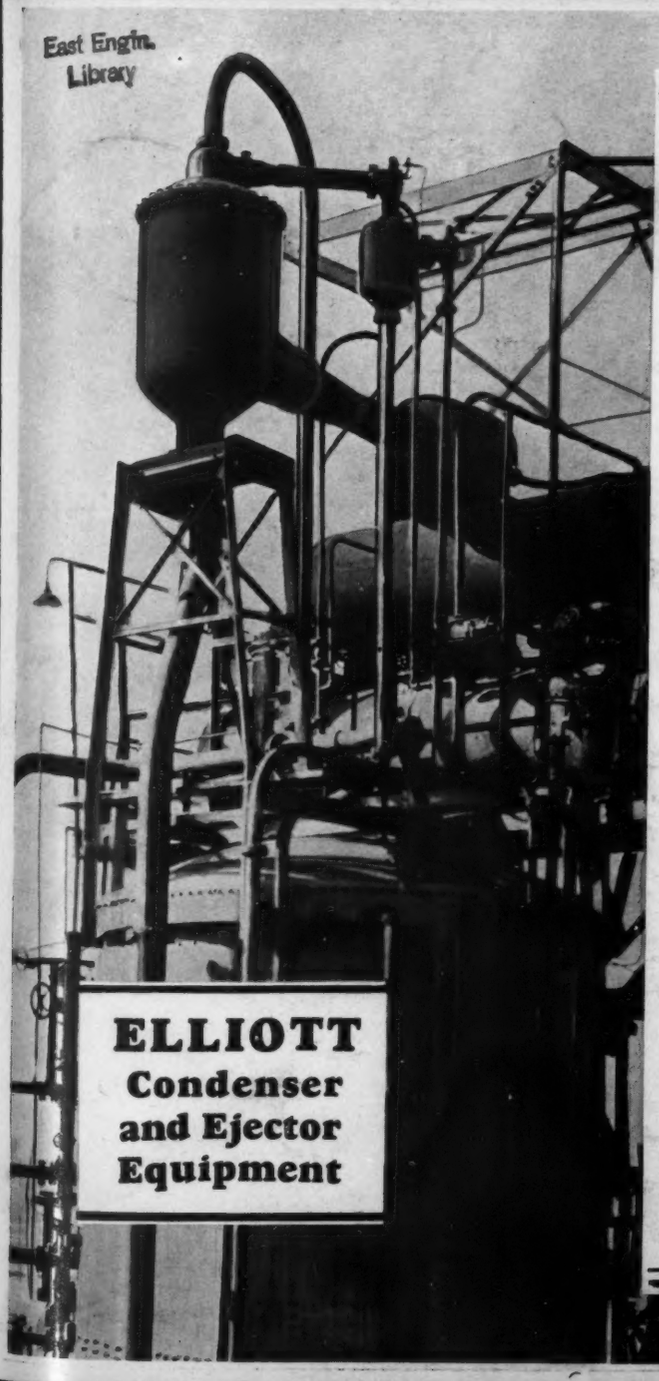

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GRADY TRIPLETT, *Editor*

GEORGE REID, *Associate Editor*

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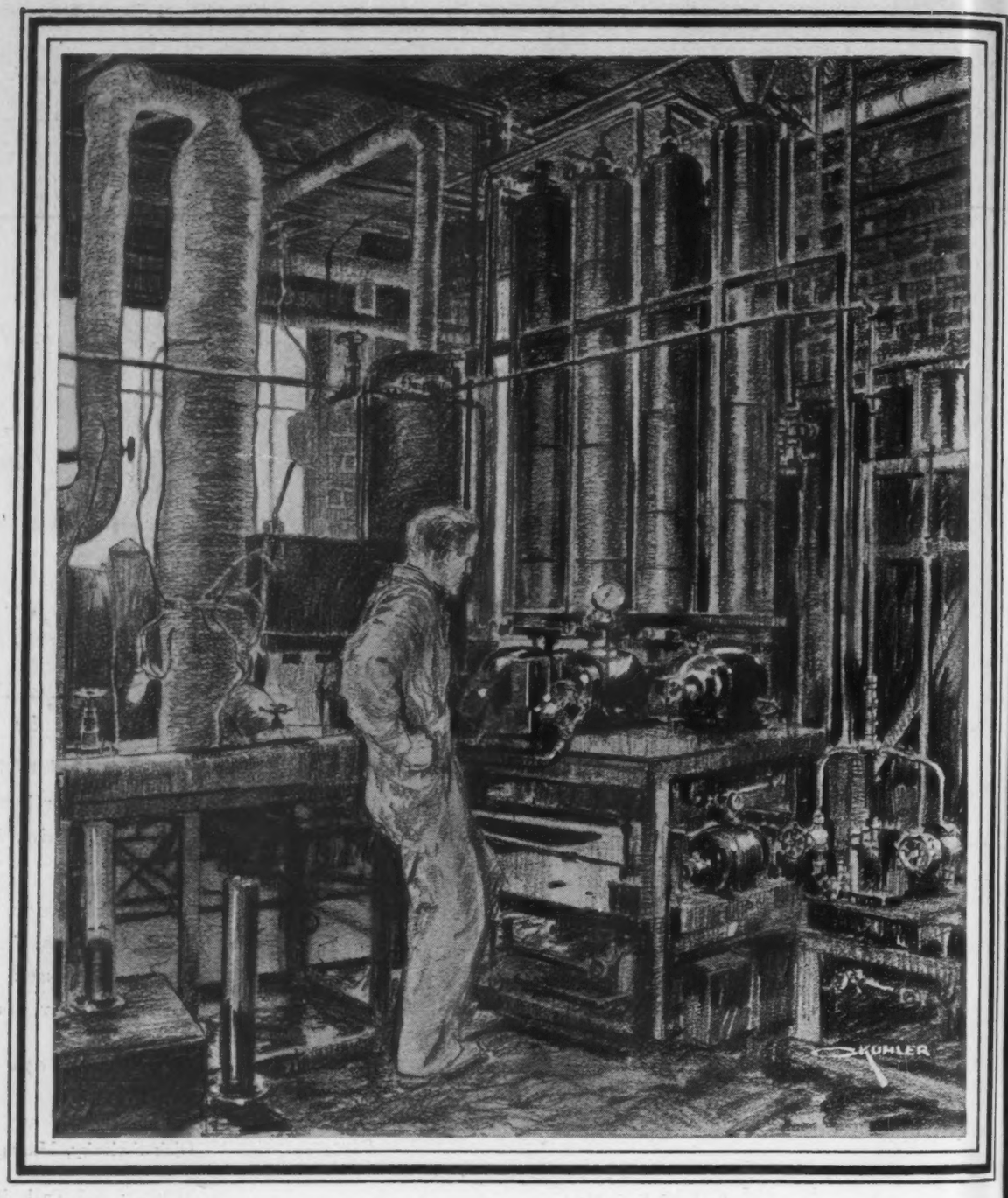

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Volume or Dollars?

INCLUDED in this issue are various tables and analyses showing recent growth of refining capacity in the United States, which of course shows the total rated capacity and approximate current operations.

And, probably most important, it shows that current operations are producing refined oil in such quantity that accumulated stocks are not being reduced in volume normal to the season.

In the meantime production of crude oil is at the highest point in history, with the prospect that the end is not yet. Efforts at curtailment of this output have proven unavailing. Too many interests are involved, it appears, to get that concerted action which would bring about a reduction in crude recovery. Strictly from the refiners' standpoint, the more crude produced and the lower the price, the better. But the refiner is so closely allied with the producer and, on the other end the marketer, that prosperity to the refiner must accompany prosperity to the other branches.

We have the figures on refinery capacity and operations because those figures are available, together with figures on stocks. But the most important figures are secret in the books of the various units of the industry, and they show the profit or loss.

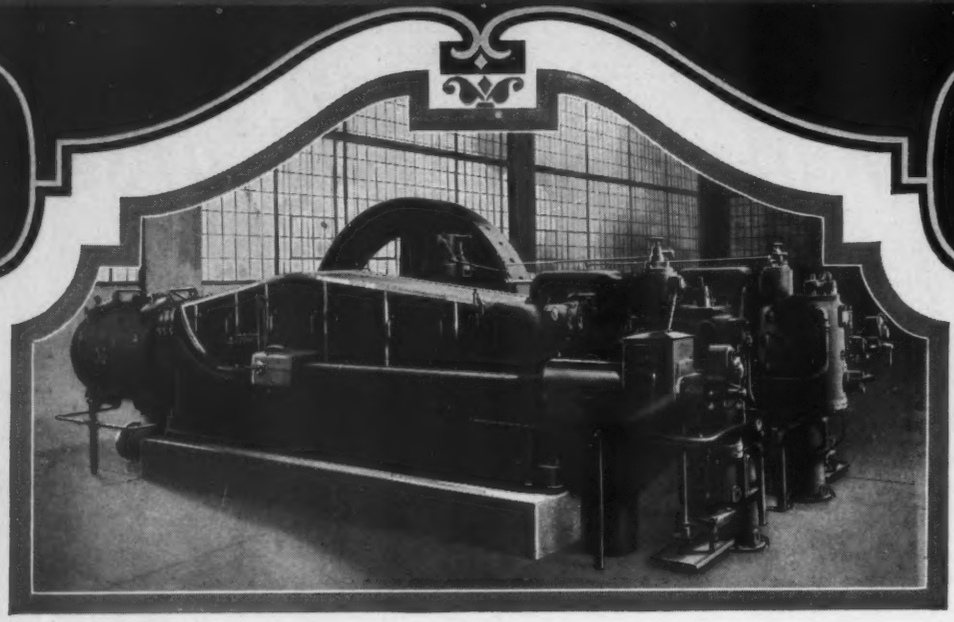
With most commodities over-supply means lowering of price because consumption can be increased through that means. But apparently that situation does not apply in the oil business at this time.

Certainly, with refineries processing more oil than appears justified at this time, cheaper crude would not induce refiners to run more crude. Producers have been threatened with lower prices unless they stop piling up their output, so it would appear that they do not look upon such a reduction as an unbearable calamity.

In the case of gasoline: This product is being sold to the consumer at a fair price. Consumption is good in keeping with the general prosperity of the country. A lower price, even if it were economically possible for refiners to sell it lower, would not increase consumption enough to offset one rainy week-end. On the other hand, any upset in general business which might affect general prosperity and employment would have an immediate effect in reducing consumption. This possibility is certainly not favorable to further accumulation of stocks.

It would appear that it is far more economical to store oil supplies as crude, since the producing end of the business can not be induced to keep it in the most logical place of all—in the ground.

The oil business, in all its branches, is too prone to count its success and accomplishments in units of production. More attention should be paid to figures with dollar signs in front. How many gallons of gasoline produced is not so important as is how much profit was made in the operation.



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Refinery Still Runs Continue Above Normal

Texas and California refiners running too much crude; gasoline supply above last year

By H. J. STRUTH
Staff Economist

ANALYSIS of operating data contained in the May report of the U. S. Bureau of Mines, reveals that still runs continue above normal requirements, while only slight improvement was made in reducing the cumulative excess. According to preliminary estimates of potential gasoline demand and normal crude requirements, runs to stills for the first five months of this year should have aggregated 389 million barrels. According to the Bureau of Mines report, cumulative runs of crude to stills during that period aggregated 396 million barrels, or an excess of about seven million barrels to date. At the close of April, the indicated excess of crude still runs was 7,144,000 barrels, while at the end of May the excess was 7,051,000 barrels, indicating that only slight improvement had been made during May.

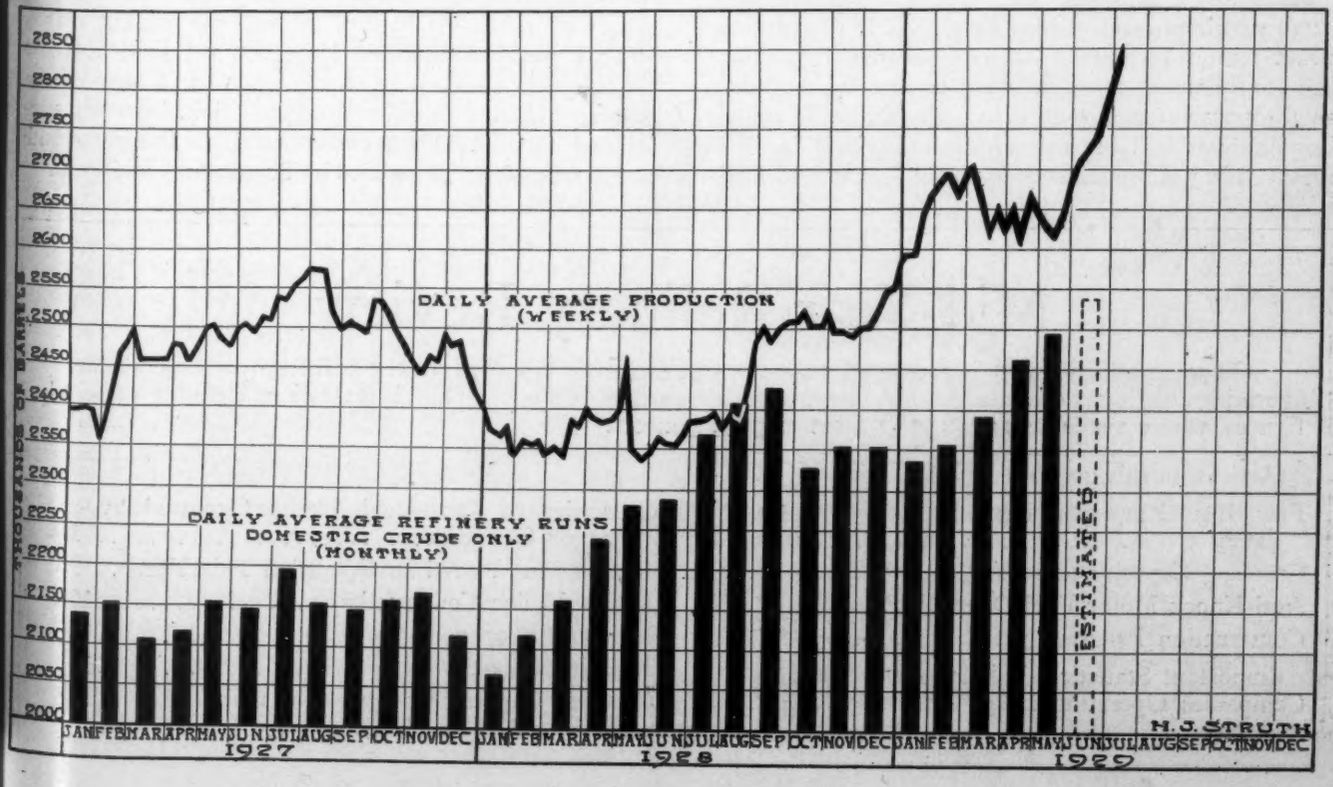
Table 1 shows how actual refinery still runs of crude compare with the predetermined normal for the first five months of this year.

TABLE 1
Normal and Actual Still Runs
(Thousands of Barrels)

	Normal		Actual	
	Month	Cumulative	Month	Cumulative
January . . .	74,546	74,546	78,825	78,825
February . . .	71,712	146,258	72,031	150,856
March	78,843	225,101	80,708	231,564
April	79,778	304,879	80,459	312,023
May	84,513	389,392	84,420	396,443

Further analysis shows that Texas and California are chiefly responsible for running excessive amounts of crude through stills, while other refining areas are maintaining operating schedules more in conformity with normal requirements. As a matter of fact, the operating figures show that Texas refineries processed 85,544,000 barrels of crude during the first five months of this year, compared with an indicated normal of 80,619,000 barrels, or an excess of 4,925,000 barrels. Simi-

Domestic Refinery Runs and U. S. Production



larly, California refineries processed 95,194,000 barrels of crude during the same period, compared with an indicated normal of 90,939,000 barrels, or an excess of 4,255,000 barrels. Refineries in both of these states increased still runs during May, increasing their combined excess to a total of 9,180,000 barrels. The fact that runs were somewhat below normal requirements in other refining states, resulted in showing a slight improvement in operations for the industry as a whole.

Many are of the opinion that gasoline stocks are now at comparatively the lowest level in many years. On the basis of average motor vehicle registration, the facts show that gasoline stocks on May 31 constituted 71 gallons per motor vehicle, as compared with 69 gallons on the same date last year. Table 2 shows how gasoline production and stocks compare for the first five months of 1928 and 1929.

TABLE 2
Gasoline Production and Stocks Per Motor Vehicle
(Gallons)

	Production		Stocks	
	1928	1929	1928	1929
January	52	54	67	64
February	50	50	72	72
March	54	55	75	76
April	54	55	74	74
May	57	57	69	71

This data also shows that gasoline production has been somewhat above the rates established last year, bearing out the fact that still runs are in excess of normal requirements. Therefore, stocks of gasoline have been maintained at a slightly higher level than during the same period of last year, even in the face of a record-breaking demand.

While the refinery situation can be likened somewhat to conditions last year, reflecting a continuation of improvement, it must be conceded that there is room for further improvement in operating schedules, particularly in Texas and California. The fact remains that even though vast improvement has taken place in the gasoline market and it is possible to make money therefrom, some consideration must be given to the effect of continued excessive runs to stills in order that a fair state of equilibrium will be maintained throughout the balance of this year. Unless refiners in Texas and California exercise caution in running crude, there is likelihood of accumulating excessive gasoline stocks to be carried into next year. To date, business has been unusually good for the refining industry, but in order that this condition may continue, it is up to those who are indulging in the excesses cited to pare their operating schedules to somewhat conform with normal requirements. An example of what is being accomplished in other refining areas in the way of maintaining normal operating schedules is illustrated by the following results:

East Coast—Cumulative crude still runs for first five months of 1929 aggregated 69,322,000 barrels, as compared with an indicated normal of 72,195,000 barrels.

Appalachian—Cumulative crude still runs for first five months of 1929 aggregated 14,020,000 barrels, as compared with an indicated normal of 14,031,000 barrels.

Indiana-Illinois—Cumulative crude still runs for first five months of 1929 aggregated 42,828,000 barrels, as compared with an indicated normal of 40,901,000 barrels.

Oklahoma-Kansas—Cumulative crude still runs for first five months of 1929 aggregated 46,080,000 barrels, as compared with an indicated normal of 47,383,000 barrels.

Louisiana-Arkansas—Cumulative crude still runs for first five months of 1929 aggregated 32,829,000 barrels, as compared with an indicated normal of 31,942,000 barrels.

Rocky Montain—Cumulative crude still runs for first five months of 1929 aggregated 10,630,000 barrels, as compared with an indicated normal of 11,344,000 barrels.

Thus far, 1929 appears to offer an opportunity to the refining industry to establish new records in its financial history as well as annual volume of business. Earnings for the first half of this year are said to be considerably above the records established last year, with the possibility of increasing further through the present season of peak gasoline demand. However, the final outcome for this year depends primarily upon the ability of the refining industry to maintain equilibrium between supply and demand. This resolves itself to the immediate paring of still run schedules in Texas and California.

Mid-Year Refinery Review

On pages which follow is presented a most comprehensive review of recent refinery construction and operating conditions compiled by Mr. George Reid, Associate Editor. This information includes official figures, where available, and figures from original sources.

Articles in this group include:

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Few Big Companies Dominate Refinery Capacity

Nineteen companies have 75 per cent of total crude capacity and 80 per cent of cracking facilities in the United States

By GEORGE REID
Associate Editor

ANALYSIS of the petroleum refining facilities of 19 companies with rated refinery capacities ranging from 25,000 to 468,000 barrels per day, imparts the interesting information that this group of refiners have 75.795 per cent. of the total rated crude refining capacity in the United States. Further, this same group of 19 companies has 80.87 per cent of the total cracking capacity of this country.

While the refining industry during the last year has expanded its crude capacity by 8 per cent., this group of leading refiners has added slightly better than 13 per cent. to its total. In cracking capacity the 19 companies have increased their total by approximately 5 per cent. These figures include present construction work engaged in by the companies involved.

The companies included in this survey and listed in Table No. 1, have 140 refineries (32.78 per cent. of all plants in this country) with an aggregate capacity rating of 2,735,100 barrels per day and a total cracking capacity rating of 1,194,407 barrels. To this total of cracking capacity these same companies are building 78,300 barrels additional capacity, or an addition of 5.3 per cent. The analysis of company holdings as presented here is based upon Bureau of Mines Information circular 6116 (Refineries) and circular 6127 (Cracking units). The companies are grouped according to capacity, making three classifications.

SIX COMPANIES: 45 PER CENT.

Group No. 1, consisting of the five largest refining companies with total rated capacity above 200,000 barrels daily, includes such well known organizations as Standard Oil Company of New Jersey, Standard Oil Company of California, Shell Union Oil Company, Standard Oil Company of Indiana. The Texas Company and Standard Oil Company of New York. With a total of 73 refineries these six companies have a total rated crude handling capacity of 1,632,950 barrels, or the equivalent of 45.25 per cent. of the total refining capacity in this country. In addition, these same companies have more than half of the cracking capacity, or 53.45 per cent., as is indicated by the total capacity of 789,397 barrels. Four companies, at 11 refineries are building 28 cracking units with a total capacity of 55,300 barrels. Also in this group there are four refineries under construction aggregating new capacity of 29,500 barrels.

Standard Oil Company of New Jersey, through its subsidiary, Humble Oil & Refining Company, is building but one refinery at this time, a 5000-barrel plant in Texas. Shell Petroleum Corporation is building in Texas a 20,000-barrel refinery with six Dubbs cracking units having capacity of 12,000 barrels per day. At East Chicago and New Orleans, Shell Petroleum Corporation is adding equipment to enlarge this department. Standard Oil Company of Indiana has two 3000-barrel Cross units under construction.

The Texas Company with 19 refineries operating throughout the United States, is building two more in Texas—at El Paso and San Antonio. At the same time this company is adding cracking equipment at Fillmore, California, Amarillo, Lockport, Illinois, Dallas, and at the new plants building. Completion of present work will give The Texas Company a total skimming capacity of 213,450 barrels, and cracking capacity of 130,765 barrels.

Standard Oil Company of New Jersey, with a crude skimming capacity of 468,000 barrels, has a wide lead over any near competitor in the country, as is also true in the case of total cracking capacity. Standard Oil Company of California is its closest rival in skimming, with a total of 255,000 barrels capacity. Standard Oil Company of Indiana, with cracking capacity of 169,723, is the New Jersey company's nearest rival in that department. It is interesting to note that although popular opinion does not usually regard Standard Oil Company of New York as a major factor in refining, nevertheless, this company has 12 refineries, five of which are owned by Magnolia Petroleum Corporation and four by General Petroleum Corporation, subsidiaries, and the total cracking capacity of the Standard Oil Company of New York is 68,500 barrels. Its total crude refining capacity is 208,500 barrels, making it the sixth largest refining company in the United States.

MORE EXPANSION PROBABLE

Of the 20 refineries under construction or proposed in this country, several of which are but small installations, the 19 companies listed in Table 1 are building six, all of which are permanent installations and have an aggregate capacity of 49,500 barrels daily. Four have been mentioned. The other two are Empire Oil & Gas Company's plant at Chicago and Gulf Refining Company's plant at Sweetwater, Texas. The tendency of this group is not so much toward building new plants as it is toward enlarging capacity at their established refineries.

Of the 50 cracking units under construction in this

country at the present time having a total capacity of 105,800 barrels and including the installation of the Gulf Refining Company at Sweetwater, Texas, this group of 19 companies has 38 new units under way, with aggregate capacity of 78,300 barrels. This means that construction of cracking units by companies not included in Table 1 totals but 12 units with total capacity of 27,500 barrels. This table, therefore, shows which companies are engaging most extensively in expansion of cracking and refining facilities. Information withheld from publication indicates that expansion in the refining industry in the near future will find these leading refiners well represented in such future work. A similar survey a year later will show still greater increases in both cracking and skimming capacity for such a group. In addition to skimming and liquid phase cracking expansion, many companies of this class will install vapor phase cracking equipment during the coming year, some of such projects having already been announced. It is highly probable that a survey next year will show some 25 or 30 vapor phase units built or under construction in addition to those which are at present building or proposed. The analysis indicates that several companies have not yet reached the proper balance between cracking and skimming facilities, and no doubt this condition will be improved through the addition of more liquid phase cracking equipment in the next year or so.

SECOND GROUP

In the second group, as shown in Table 1, five companies are listed in sequence of their skimming plant capacity and the group consists of those companies whose refining capacity ranges between 100,000 and 200,000 barrels per day. During the past year this group of companies has added slightly better than 12 per cent. to its total crude running capacity and about 6 per cent enlargement is noted in its cracking capacity as compared with the status of the same group last year.

These five companies operate 32 refineries having a total capacity of 716,600 barrels per day. The cracking capacity of this group is 207,600 barrels. These figures represent 19.85 per cent of the skimming capacity of the industry in the United States, and 14 per cent of the total cracking capacity.

Adding "group one" and "group two" we find that 11 companies operate 105 refineries in this country having an aggregate skimming or crude capacity of 2,349,550 barrels, or 65.10 per cent of the total capacity of the industry in this country. Further, these same 11 companies have a total of 996,997 barrels daily cracking plant capacity, which is 67.5 per cent. of the total domestic cracking capacity.

Through mergers and expansion programs the second group consists of three more companies in the class between 100,000 and 200,000 barrels capacity than was the case last year. Gulf Refining Company, through expansion and addition of one refinery, very nearly entered the first group this year and will possibly do so next year. Tide-Water Associated Oil Company shows an increase of about 25,000 barrels daily capacity over its rating a year ago. Sinclair Refining Company added about the same through enlargements. Richfield Oil Company, through merging with Pan-American and securing the Watson refinery of 60,000 barrels capacity, as well as through enlargement of its original plant at Hynes, brought its total capacity up to 121,500 barrels skimming and doubled its cracking capacity. Union Oil Company, with six refineries, entered group two by enlarging capacity. Its cracking capacity is increased through its new work with Leintz and Carborundom processes which were placed in operation this year.

Additional expansion is contemplated by some of these five companies, especially in the cracking department where three of them are relatively weak. It is reported that Gulf Refining Company will erect a refinery near Now York some time during the next year. Since Gulf Refining Company and The Texas Company control the new De Florez cracking process, it is highly possible that additional units of this process will be erected by both companies soon. It is reported that three or four other large companies are contemplating installation of the De Florez process. Erection of cracking units by the members of the second group is at present limited to Gulf Refining Company's construction of its Buerger process at Sweetwater and its six 3000-barrel Holmes-Manley units at Port Arthur.

THIRD GROUP

In the third group, Table 1, there are listed eight companies whose daily refining capacity ranges from 25,000 barrels to 100,000 barrels. There are three or four other companies, with capacities ranging between 20,000 and 25,000 barrels, which might well be included in a list of "leading refiners" but this survey is made for the primary purpose of showing those larger companies whose total capacity aggregates 75 per cent. of the re-

TABLE 1

Companies, including subsidiaries	Number plants including bldg.		Total rated crude cap.	Total rated cracking cap.	Cracking Capacity Building
Standard Oil Co., (N. J.)	15	(1-Bldg.)	468,000	264,400	
Standard Oil Co., (Cal.)	5		255,000	40,000	
Shell Union Oil Co.	9	(1-Bldg.)	252,500	116,000	18,000 Dubbs
Standard Oil Co., Indiana	11		235,000	169,723	6,000 Cross
The Texas Company	21	(2-Bldg.)	213,450	130,764	19,300 Cross-7 H. M., 3
Standard Oil Company, (N. Y.)	12		208,500	68,500	12,000-4 Cross (Mag.)
Total—Six Companies	78		1,632,950	789,397	55,300
Gulf Refining Company	5	(1-Bldg.)	197,000	58,600	18,000-6 H. M. 5,000-6 Gulf
Tidewater Associated Oil Co.	7		159,500	9,500	
Sinclair Consolidated Oil Corp.	8		134,200	100,000	
Richfield Oil Company	6		121,500	24,500	
Union Oil Company	6		104,400	15,000	
Total—Five Companies	32		716,600	207,600	23,000
Atlantic Refining Company	4		72,000	44,000	
Continental Oil Co., (Marland)	8		65,750	36,010	
Cities Service Companies	8	(1-Bldg.)	55,800	18,700	
Pure Oil Company	6		55,000	40,200	
Sun Oil Company	3		42,600	24,000	
Mid-Continent Pet. Corp.	1		40,000	18,500	
Louisiana Oil Ref. Corp.	3		30,000	10,000	
Vacuum Oil Company	2		25,000	6,000	
Total—Eight Companies	35		385,550	197,410	
Grand Total—19 Companies	140		2,735,100	1,194,407	78,300

Table Number 1A

Company No. 1. Standard Oil Co., (N. J.)	Rated Crude Capacity	Rated Cracking Capacity
Baltimore, Md.	32,000	20,400
Bayonne, Jersey City, & Linden, N. J.—3 plants	180,000	83,500
Charleston, S. Carolina.	15,000	10,000
Parkersburg, West Va..	4,000	4,500
	231,000	118,400
Humble Oil & Refg. Co.		
Baytown, Texas	100,000	39,000
Breckenridge	1,500	.....
Chilton	1,500	
Ingleside	15,000	6,000
McCamey	15,000	6,000
San Antonio	4,000	
Boggy Creek	5,000 Bldg.	
	142,000	51,000
Beacon Oil Company		
Everett, Mass.	25,000	25,000
Standard Oil Co., La., Baton Rouge	70,000	70,000
	95,000	95,000
Grand Total—Standard Oil Co., New Jersey, 15 plants..	468,000	264,400
Company No. 2.		
Standard Oil Co., (Calif.)		
El Segundo, Cal	100,000	20,000
Richmond, Cal.	100,000	20,000
Bakersfield, Cal.	25,000	.....
	225,000	40,000
Paso Tex. Ref. Corporation, El Paso, Texas..	10,000	
Col-Tex. Ref. Co. (62½%-owned) Colorado, Texas	10,000	.....
Grand Total—5 plants.....	255,000	40,000
Company No. 3.		
Shell Union Oil Corp.		
Shell Oil of Cal.		
Martinez	35,000	19,000
Watson & Dominguez..	51,000	38,000
Coalinga	3,500	.....
	89,500	57,000
Shell Pet. Corp.		
Wood River, Ill.	46,000	18,000
East Chicago, Ind.	27,000	11,000
Arkansas City, Kansas.	20,000	10,000
Norco, La.	20,000	8,000
Houston, Texas	20,000 Bldg.	12,000 Bldg.
	133,000	59,000
Shell East P. P. Inc.		
Boston, Mass.	30,000	.....
Grand Total—9 plants	252,500	116,000
Company No. 4.		
Standard Oil Co. (Indiana)		
Wood River, Ill.	28,000	26,000
Whiting, Ind.	78,000	98,600
Sugar Creek, Mo.	13,000	19,643
Zilwaukee, Mich.	1,500	.....
	120,500	144,243
Mexican Pet. Corp.		
Baltimore, Md.	8,000	.....
Destrahen, La.	30,000	.....
	38,000	
Mid-West Ref. Company		
Casper, Wyoming	50,000	6,200
Greybull, Wyoming	10,000	4,680
Laramie, Wyoming	4,000	3,100
	69,000	13,980
Utah Oil & Ref. Co.		
Salt Lake City, Utah...	4,500	9,500
Dixie Oil Company		
Superior, La.	3,500	2,000
	8,000	11,500
Grand Total—11 plants....	235,500	169,723
Company No. 5.		
The Texas Corporation		
Port Arthur, Texas....	60,000	79,200
Port Neches, Texas....	20,000	.....
Houston, Texas	20,000	1,714 re-bldg.
West Dallas, Texas....	16,000	3,000
Amarillo, Texas	3,000	.....
San Antonio, Texas....	3,000 Bldg.	3,300 Bldg.
El Paso, Texas	1,500 Bldg.	1,650 Bldg.
West Tulsa, Okla.	14,000	16,800
Lockport, Ill.	6,000	5,500
Shreveport, La.	6,500	.....
Pryse, Kentucky	2,000	2,000
Casper, Wyoming	7,000	9,400
Cody, Wyoming	3,000	1,600
Craig, Colorado	750	500
Sunburst, Mont.	6,000	.....
Norfolk, Va.	1,500	.....
Marcus Hook, Pa.	1,500	.....
Providence, R. I.	1,200	.....
	172,950	124,664
The Texas Company of Cal.		
Coalinga	1,500	.....
Watson	35,000	5,000
Filmore	4,000	1,100 Bldg.
	40,500	6,100
Grand Total—21 plants	213,450	130,764
***Owned by International Refining Co.		
Company No. 6.		
Standard Oil Company of New York		
Greenpoint, N. Y., 2 plts	19,000	8,000
Buffalo, N. Y.	4,500	2,000
Providence, R. I.	10,000	6,000
	33,500	16,000
Magnolia Pet. Corp.		
Beaumont, Texas	55,000	47,500
Magpetco	10,000	.....
Luling	2,000	.....
Corsicana	3,000	.....
Fort Worth	5,000	2,000
	75,000	49,500
General Pet. Corp.		
Vernon, Cal.	55,000	3,000
Lebec, Cal.	12,000	.....
Olinda, Cal.	3,000	.....
Torrance, Cal.	30,000	.....
	100,000	3,000
Total—12 plants	208,500	68,500
Grand Totals—6 companies 73 plants	1,632,950	789,397

Table Number 2

	Rated Crude Capacity	Rated Cracking Capacity
Company 1.		
Gulf Refining Company		
Refineries		
Bayonne, N. J.	30,000	1,000
Girard Point, Pen.	32,000	.....
Fort Worth, Texas	5,000	4,200
Port Arthur, Texas	125,000	49,400
Sweetwater, Texas	5,000 Bldg.	4,000 Bldg.
Total—5 plants	197,000	58,600
Company 2.		
Tide Water Associated Oil		
Associated Oil Co., (Cal.)		
Avon	60,000	.....
Martenez	10,000	.....
Taft	1,500	.....
Watson—both plants	25,000	.....
	96,500	.....
Tide Water Oil Co.		
Bayonne, N. J.	50,000	6,500
Tidal Oil Company		
Drumright, Oklahoma	10,000	3,000
Tidal Western Oil Co.		
Burkburnett, Texas	3,000	.....
Total—7 plants	159,500	9,500
Company 3.		
Sinclair Consolidated Oil		
Corporation		
East Chicago, Ind.	40,000	40,000
Coffeyville, Kans.	10,000	10,000
Argentine, Kansas	9,000	10,000
Meraux, La.	30,000	.....
Muskogee, Oklahoma	1,200	.....
Marcus Hook, Penn.	17,000	20,000
Houston, Texas	23,000	20,000
Wellsville, N. Y.	4,000	.....
Total—8 plants	134,200	100,000
Company 4.		
Richfield Oil Co., of Cal.		
Refineries		
Bakersfield	2,000	.....
Fellows	3,000	.....
Hynes	50,000	12,500
Long Beach	3,500	.....
Los Angeles	4,000	.....
Pan American—Watson	60,000	12,000
Total—6 plants	121,500	24,500
Company 5.		
Union Oil Co., of Cal.		
Refineries		
Avila	10,000	.....
Brea	6,000	.....
Maltha	5,000	.....
Oleum	27,500	.....
Santa Paula	900	.....
Wilmington	55,000	15,000
Total—6 plants	104,400	15,000
Grand Totals — 5 companies		
32 plants	716,600	207,600

Table Number 3

	Rated Crude Capacity	Rated Cracking Capacity
Company 1.		
Atlantic Refining Company		
Franklin, Pa.	9,000	6,000
Philadelphia	50,000	32,000
Pittsburgh	8,000	4,000
Brunswick, Georgia	5,000	2,000
Total—plants	72,000	44,000
Company 2.		
Continental Oil Company		
(Marland Oil)		
Florence, Colorado	2,500	1,170
Artesia, N. M.	1,500	.....
Farmington, N. M.	750	.....
Sapulpa, Oklahoma	10,000	3,600
Wichita Falls, Texas	6,000	2,400
Glenrock, Wyoming	10,000	2,840
	30,750	10,010
Marland Refining Co.		
Ponca City, Okla.	28,000	19,600
Prudential Refining Corp.		
Baltimore, Md.	7,000	6,400
Total—8 plants	65,750	36,010
Company 3.		
Cities Service Companies		
Empire Oil & Gas Co.		
Cushing, Oklahoma	4,700	1,500
Okmulgee, Oklahoma	4,000	1,000
Ponca City, Oklahoma	7,500	4,500
Gainesville, Texas	3,600	3,000
Chicago, Illinois	15,000 Bldg.	
Cities Service Ref. Co.		
East Braintree, Mass.	15,000	7,000
Crew Levick Company		
Pettys Island, N. J.	4,000	1,700
Oil City, Pennsylvania	2,000	.....
Total—8 plants	55,800	18,700

Company 4. Pure Oil Company	Rated Crude Capacity	Rated Cracking Capacity
Heath, Ohio	5,000	5,000
Ardmore, Okla.	2,000	2,000
Muskogee, Okla.	5,000	5,000
Marcus Hook, Penns.	10,000	11,000
Smiths Bulff, Texas	30,000	16,000
Cabin Creek, W. Va.	3,000	1,200
Total—6 plants	55,000	40,200
Company 5.		
Sun Oil Company		
Refineries		
Toledo, Ohio	12,000	.....
Yale, Okla.	5,000	.....
Marcus Hook, Pa.	25,000	24,000
Total—3 plants	42,000	24,000
Company 6.		
Mid-Continent Pet. Corp.		
West Tulsa, Oklahoma	40,000	18,500
Total—1 plant	40,000	18,500
Company 7.		
Louisiana Oil Refg. Corp.		
Bossier City, No. 1	12,000	10,000
Bossier City, No. 2	3,000	.....
Gas Center	15,000	.....
Total—3 plants	30,000	10,000
Company 8.		
Vacuum Oil Company		
Paulsboro, New Jersey	18,000	4,200
Olean, New York	7,000	1,800
Total—2 plants	25,000	6,000
Total—8 companies—35 plts	385,550	197,410
Grand Totals:		
Tables—1, 2, 3.		
Total 19 companies, 140 plants	2,735,100	1,194,407

fining capacity of this country by working down to the arbitrary capacity figure of 25,000 barrels daily.

Atlantic Refining Company, with four plants having a total capacity of 72,000 barrels and cracking capacity of 44,000 barrels, heads this group. Atlantic Refining Company's refining work is all done in the eastern territory at present.

Since the merger of Continental Oil Company and Marland Oil Company, together with the merger with Prudential Refining Corporation at Baltimore, the combined eight plants of the three companies are now listed under Continental Oil Company. It has a total crude running capacity of 65,750 barrels and cracking capacity of 36,010 barrels.

Cities Service Companies are adding one refinery at present at Chicago. It is also modernizing the cracking installation of Crew Levick Company at Petty's Island, N. J. The total skimming capacity is 55,800 barrels and cracking rated at 18,700. Pure Oil Company in this group has increased its crude running capacity to 55,000 barrels during the past year and through the installation of several units of its Gyro Vapor Phase cracking process, as well as an enlargement of its Cross cracking facilities, this company now has a rated cracking capacity of 40,200 barrels in its six refineries.

Sun Oil Company with three refineries has a rated capacity of 42,000 barrels, and through the recent installation of two 4000-barrel units of its own cracking process, has increased cracking capacity to 24,000 barrels. Mid-Continent Petroleum Corporation has its same crude capacity rating of 40,000 barrels per day but has increased its cracking capacity to 18,500 barrels. Louisiana Oil Refining Corporation with three refineries totaling 30,000 barrels capacity has Tube and Tank Beacon Coil cracking units totalling 10,000 barrels capacity. Vacuum Oil Company with two plants in the eastern district has crude capacity of 25,000 barrels and 6000 barrels cracking capacity.

The total capacity of these eight companies in "group three" in Table 1, operating 35 refineries, is 385,550 barrels daily, or 10.6 per cent. of the total capacity of the industry in this country. The same group has an aggregate cracking capacity of 197,410 barrels, or 13.36 per cent. of the total for the country. The combined total capacity of all plants or companies in this group in both crude and cracking capacity is quite a bit less than that of the Standard Oil Company of New Jersey alone. Other than the 15,000-barrel refinery under construction at Chicago there is no expansion work of moment under way by the companies in this group.

The combined total of all three groups in Table 1,—19 companies operating 140 refineries, is 2,735,100 barrels crude capacity and 1,194,407 barrels cracking capacity. Since there is a total of 427 plants listed in Bureau of Mines survey of January 1 (Circular 6116) there are 287 plants in this country which have but 25 per cent. of the total refining capacity of the United States.

The total capacity for the 19 companies listed in Table 1 being 2,735,100 barrels, and as the total capacity of the refining industry in the United States is 3,608,540 barrels, the remaining capacity of 873,440 barrels is the total of the 287 plants which have 25 per cent. of the domestic skimming capacity.

As these leading refiners have 80 per cent. of the cracking capacity of the domestic refining industry with a total of 1,194,407 barrels, and since the total cracking capacity of all 2205 cracking units in this country is 1,476,874, then the remaining 282,467 barrels of cracking capacity is distributed among those plants operated by companies not included in Table 1.

Such an analysis of the refining industry is indicative of the fact that the larger units are strengthening their positions. This trend has been distinctly noticeable for the past few years and every indication points to a continuation of such endeavor. While most of the expansion work has been carried out by the companies as presented in this article there has been quite a little growth and development among a number of organizations not included in this list and several of these smaller companies have enjoyed greater growth during the past year or two than their larger competitors. Compared to such other industries as the automotive, public utility, and steel, the petroleum refining industry is divided among a relatively large number of competitive units.

Cracking Capacity Increased 26 Per Cent During Year; 19 Plants Install Equipment

OF the 427 refineries in the United States listed by the Bureau of Mines, January 1, there are 196 which are provided with cracking equipment. The total cracking capacity as of June 1 and as reported in the accompanying survey of cracking units aggregates 1,675,400 barrels per day. These figures show an increase since the summer of 1927, when a similar survey conducted by this magazine was published, of 438,670 barrels capacity. During the same period, 19 more refineries were equipped with cracking facilities.

A further increase in capacity is indicated by the fact that on June 1 there were 46 cracking units being installed in this country with a total of 97,800 barrels capacity. The addition of present construction will increase cracking capacity of the United States refineries to 1,773,200 barrels daily. With a total crude charging capacity for the industry of 3,608,540 barrels, the cracking capacity is now slightly more than half of the total rated capacity of this country's refineries. Such comparisons not only indicate that there has been a marked growth in the number of plants operating cracking units and in the total capacity of all cracking facilities, but also show that continued expansion may be expected in this phase of petroleum refining.

The 196 refineries operating "crackers" are distributed throughout 26 states. Texas continues to lead in number of refineries so equipped, in the number

TABLE NUMBER 5

Status of the cracking phase of the refining industry June 1, 1929.

State—	Number Refineries Cracking	Cracking Capacity Barrels	Shut Down Plants	Shut Down Capacity	Building Units	Building Capacity
Arkansas	6	13,350	.	...	.	...
California	15	143,950	.	...	1	1,500
Colorado	2	2,000	.	...	.	...
Georgia	1	2,000	.	...	.	...
Illinois	9	77,200	1	1,500	2	4,000
Indiana	4	106,000	.	...	4	8,000
Iowa	1	1,500	1	1,500	.	...
Kansas	16	77,950	3	3,000	.	...
Kentucky	6	9,700	.	...	.	...
Louisiana	6	79,500	.	...	4	4,000
Maryland	3	60,600	.	...	.	...
Massachusetts	2	22,800	.	...	.	...
Michigan	1	Bldg. 3,050	.	...	.	See col. 1 & 2
Missouri	2	16,200	.	...	1	2,000
Montana	1	800	.	...	.	...
New Jersey	8	192,200	.	...	.	...
New York	3	14,000	.	...	.	...
Ohio	6	37,000	.	...	.	...
Oklahoma	30	118,750	.	...	4	10,000
Pennsylvania	21	96,800	.	...	.	...
Rhode Island	1	10,000	.	...	.	...
South Carolina	1	34,400	.	...	.	...
Texas	36	459,700	2	2,100	28	68,300
Utah	1	9,000	.	...	.	...
West Virginia	5	15,550	.	...	.	...
Wyoming	9	71,400	1	1,000	.	...
Totals	196	1,675,400	9	11,100	46	97,800

Refineries with cracking plants	195	Total capacity	1,675,400 bbls.
Shut-down Ref. with crack. plts.	9	Total capacity	11,100 bbls.
Operating Ref. with crack. plts.	187	Total capacity	1,664,300 bbls.
Total capacity cracking U. S. 196 plants			1,675,400 bbls.
Total building capacity as of June 1			97,800 bbls.
Total indicated capacity, U. S. completion of present work			1,773,200 bbls.

of units installed, the total capacity, and in number of new units under construction. There are now 36 Texas refineries cracking with a total capacity of 459,700 barrels, and at this time there are 28 units under construction in that state which will add 68,300 barrels to its present rated capacity.

Oklahoma, which is second in number of refineries which are cracking, has 30 plants so equipped with a total capacity of 118,750 barrels. In point of capacity, New Jersey and California refiners surpass the Oklahoma operators. Eight refineries in New Jersey have a total cracking capacity of 192,200 barrels. In California, 15 refineries have a total cracking capacity of 143,950 barrels.

The accompanying list of cracking plant installations indicates the increased capacity of the various states, giving the company name, plant location, skimming capacity, type of plant, and the cracking capacity with type of process employed. This material, while not infallible, is as near accurate as possible, and is intended to show the trend of cracking development in the various refining districts as well as with individual companies. It indicates the status of cracking within the industry as of June 1, 1929.

In Table 1, which is a recapitulation of state totals as presented in the list of installations, there is shown the number of refineries which are cracking in each state, the total cracking capacity as of June 1, and the number of units under construction in each state at present with their total rated capacities.

According to a survey conducted by the Bureau of Mines, "Survey of Cracking Plants," by G. R. Hopkins, under date of January 1, 1929, Information Circular 6127, there was a total cracking capacity at that time of 1,476,874 barrels, and a total number of units of 2,205. Capacity building at that time was 134,450 barrels, with 71 units. Much of this work has since been completed and a number of new projects started and others announced. This situation as to cracking units under construction and those completed and placed in operation since January 1, 1929, is discussed in another article. One of the most interesting features noticed in the Bureau of Mines survey is the preponderance of certain well-known units or processes. With 36 different cracking processes listed January 1, there was a total of 2,205 units installed.

It is interesting to break this down by processes, in their alphabetical order, showing the type of process, number of units, and total capacities, as follows:

Process	No of Units	Barrels Capacity
Burton Process	1060	192,586
Cross Process	160	232,250
Dubbs Process	186	214,600
Holmes-Manley	154	232,107
Jenkins Process	47	58,850
Tube and Tank	124	210,314
Total—Six Process	1731	1,140,707

In addition to the six leading processes now being marketed in the industry there are several strictly company processes which are employed by various organizations, such as the Buerger, Isom, Link,

Complete Survey of Cracking Capacity in the United States will be found on page 108 et seq.

Koontz, Doherty, Setzler, Slagter, Sun and others. Of this group there are but three which are employed extensively enough to total 50,000 barrels daily capacity and they have been selected to add to the group of six processes just presented. They are:

	Units	Barrels Capacity
Buerger Process, (Gulf Refining Company)	89	55,600
Isom Process, (Sinclair Oil & Gas Company)	100	100,000
Link Process, (Standard Oil Company of Louisiana)	20	53,000
Total, Three Processes	129	208,600

Adding the two lists we find that nine processes for cracking employ 1860 units and have a total capacity of 1,349,307 barrels. With these figures at hand the status of cracking industry then breaks down as follows:

CRACKING IN THE UNITED STATES

Thirty-six processes, with 2,205 units, have a total capacity of 1,476,874 barrels.
Nine processes, with 1,860 units, have a total capacity of 1,349,307 barrels.
Twenty-seven processes with 345 units have a total capacity of 127,567 barrels.

In this industry 91 per cent of the cracking capacity is included in the performance of 1,860 units from but nine processes. Bureau of Mines figures indicate that 64 per cent. of the total cracking in this country is done through the employment of five types of units: Cross, Dubbs, Holmes-Manley, Jenkins, and Tube and Tank. The total capacity of units of these five processes is 948,121 barrels.

In regard to the increasing volume of cracked gasoline reaching the markets as the consequence of extensive expansion of cracking facilities, the Bureau of Mines says, "The production of gasoline by the cracking process in 1928 amounted to 122,381,000 barrels as compared with 101,226,000 barrels in 1927, an increase of 21 per cent. Although the output of gasoline by straight-run methods and by the use of natural gasoline increased materially in 1928, the relative proportion of cracked gasoline to the total gasoline output rose from 30.7 per cent. in 1927 to 32.4 per cent. in 1928. The month of highest indicated cracking activity was November, when the proportion of cracked gasoline produced to the total was 34.3 per cent.

"In common with most other kinds of industrial equipment, the average size of cracking units has considerably increased. This fact was particularly well illustrated by this survey, which, in comparison with the 1928 survey, showed an increase in size of the average unit of from 552 barrels daily charging capacity to 670 barrels. Five years ago the majority of the new units projected were of 500 barrels daily charging capacity, but today it is not uncommon for units of 3,000 to 4,000 barrels capacity to be built."

Anti-Knock Motor Fuel Demand Responsible for Large Growth of Cracking—Many Plants Are Now Under Construction

CONCERTED effort on the part of the refining industry during the past year toward rapid expansion of its cracking facilities is attributed to the growing demand for motor fuels, especially premium grades of non-detonating gasolines. At the same time, utilization of pyrogenic equipment is a factor of no little importance in the general trend toward conservation of crude petroleum. Roughly, the cracking unit is responsible for an increase in gasoline production of 15 per cent over that recovery secured by straight skimming methods. This additional recovery contributes much to the improved quality of the general run of motor fuels. Demands of the motorists, many of whom are apparently sold on anti-knock gasoline, the ever-increasing automobile registration, the rapidly growing aviation industry and the increasing use of gasoline in agriculture and industrial enterprise all indicate that the refining industry is justified in its present program of expansion in cracking and skimming facilities.

Comparative estimates taken over six-month periods during the past 18 months are of interest in that they strikingly indicate the consistent growth of cracking. Bureau of Mines survey of January 1, 1928, showed 10 units building with a total capacity of 22,000 barrels. The survey of the Refiner and Natural Gasoline Manufacturer of June 1, 1928, recorded 16 cracking units building then with a total capacity of 30,200 barrels. Bureau of Mines Survey of January 1, 1929, showed that at the beginning of this year there were 71 cracking units building with a total capacity of 134,450 barrels. The current survey of The Refiner and Natural Gasoline Manufacturer reports that 46 units were under construction as of June 1, with a total capacity of 100,800 barrels. These figures include only the United States. During the last six months period there were 56 cracking units placed in operation in this country, effecting an addition to the cracking capacity of this country of 130,900 barrels.

ADDITIONS DURING LAST SIX MONTHS

Information secured from four of the leading manufacturers of cracking processes regarding the number of units under construction as of June 1, and the number of units placed in operation during the past six months is incorporated in Tables No. 1 and 2. The four processes contributing this data are Cross, Dubbs, Holmes-Manley, and Jenkins. Information incorporated in the tables regarding Tube and Tank process, Gyro Vapor Phase, Doherty Units, Trumble

and others was secured from the files of the writer and Bureau of Mines, Survey of Cracking Plants, Information Circular No. 6127.

Of the 59 units listed in Table 2 as being placed in operation during the last six months, 56 of them are located in this country and have an aggregate capacity of 130,900 barrels. The remaining three foreign units, with total capacity of 4,600 barrels, were located in South America.

Through the completion of seven new units of the Jenkins process and four Tube and Tank installations, Texas leads in capacity of new equipment placed in operation recently. California is second with seven new units completed. The new Trumble unit at Hynes has been completed, four Jenkins units in this state have been placed in operation and Union Oil Company is working with two new processes, the Leintz and Carborundum.

During this period the Cross process has started operation with six new units, three of which are South American—in Argentina and Patagonia. Prudential Refining Corporation is operating its two new units, and the Dixie Oil Company, near Shreveport, is running its new Cross unit. In Oklahoma, Wilcox Oil & Gas Company is operating its new Dubbs units. Holmes-Manley process is now in operation at The Texas Company's Cody, Wyoming, plant. Thirteen units of the Jenkins Process, located mostly in Texas and California have been placed in operation. The same number of Tube and Tank units have been completed recently.

Standard Oil Company of Louisiana has added four new units of the Link Process with a total capacity of 15,000 barrels. Cities Service Refining Company at East Braintree, Massachusetts, is operating two new Doherty units. At Petty's Island, New Jersey, Crew Levick Company is rebuilding its Doherty Units and modernizing the equipment. In April the cracking chambers were erected at this plant. These

(*Continued on page* 96)

TABLE 1

Installations Now Under Construction

Company and Type of Process	Location	Units	Unit Size Barrels		Total Capacity Barrels
CROSS PROCESS					
Magnolia Petroleum Company, Beaumont, Texas		4	3,000		12,000
Nippon Oil Company, Japan		1	1,000		1,000
Standard Oil Company (Ind.), Whiting, Indiana		2	3,000		6,000
Pan-American Petroleum & Transport Company, Aruba, D. W. I.		8	3,000		24,000
The Texas Company of California, Fillmore, California		1	1,500		1,500
The Texas Company, Amarillo, Texas		1	1,800	(non-resid.)	1,800
The Texas Company, Lockport, Illinois		2	2,000	(non-resid.)	4,000
The Texas Company, Dallas, Texas		3	2,000	(non-resid.)	6,000
Total		22			56,300
DUBBS PROCESS					
Independent O. & G. Company, Kansas City, Missouri		1	2,000		2,000
Independent O. & G. Company, Okmulgee, Oklahoma		1	2,500		2,500
New Orleans Refining Company—(Now Shell Petroleum Corporation) Sellers, Louisiana		4	1,000		4,000
Shell Petroleum Corporation, East Chicago, Indiana		2	1,000		2,000 est.
Shell Petroleum Corporation, Houston, Texas		6	2,000		12,000
White Star Refining Company, Trenton, Michigan		2	1,500		3,000
		16			25,500
Dubbs-Foreign—No Capacity Report—No Company Report:					
Argentina, South America		4			
Continental Europe		10			
East Indies		7			
Egypt		1			
Japan		2			
Mexico		1			
West Indies		10	(35 foreign)		25,500 est.
		51			78,000
HOLMES-MANLEY					
Gulf Refining Company, Port Arthur, Texas		6	3,000		18,000
Raffineria de Olii, Minerali S. A., Fiume, Italy		1	1,000		1,000
The Texas Company, San Antonio, Texas		2	2,000		4,000
The Texas Company, El Paso, Texas		1	2,000		2,000
Total		10			25,000
JENKINS					
Globe Oil & Refining Company, Cushing, Oklahoma		2	2,500		5,000
Iowa Park Prod. & Ref. Company, Iowa Park, Texas		1	2,500		2,500
LaSalle Petroleum Company, (Formerly Noble O. & G. Co.), Burkburnett, Texas		1	2,500		2,500
Orient Refining Company, Wichita Falls, Texas		1	2,500		2,500
Richardson Refining Co., Big Springs, Texas		2	2,500		5,000
White Oak Gaso. Co., Allen, Oklahoma		1	2,500		2,500
Raffinerie Nationales de Petroles, Bruxelles, Belgium		1	2,000		2,000
Russian Oil Commission, Russia		6	2,000		12,000
McColl Frontenac Oil Co., Ltd., Montreal, Canada		1	2,500		2,500
		16			36,500
Total		99			195,800

Salvaged Material Makes Good Heat Exchanger

By EDWARD H. FLAHARTY

HIGHER efficiencies in the utilization of heat and heat transfer is occupying the minds of refining engineers more and more along with other efficiencies which serve as the goal and life blood in all modern manufacture. Wide-awake refining engineers are giving constant thought to problems of heat transfer, and these problems are to be met only by a combination of keen observance and constant watch for methods and systems that meet the varied conditions constantly arising and changing, plus engineering skill to work out such problems for each particular case.

The heat exchanger described below is of "home made" construction of unique proportions and dimensions, and was constructed for the most part from salvaged pipe, casing, fittings, insulation, etc. It is in operation at No. 2 Battery Crude Stills at the Parco, Wyoming, refinery of Producers and Refiners Corporation, and entails the handling of crude and residuum in connection with residuum and exhaust steam.

The battery of stills in connection with which the heat exchanger operates, consists of five shell type stills 12 feet in diameter by 40 feet long, having bubble towers, is gas fired and with a gas recovery system. Five stills of similar dimensions used as pressure distillate rerun stills, complete the battery of ten stills in this unit.

The heat exchanger is 130 feet long, is made of two-inch pipe inside of four-inch tubing (¼-inch wall) inside of 6⅝-inch casing, and is three rows high by four rows wide. The exchanger is of double construction, all of the expansion being taken care of at one end; the other end is anchored.

The top row, consisting of 520 square feet of heating surface, is an exhaust steam superheater, the residuum direct from the stills flowing countercurrent to the exhaust steam and in parallel through the four rows.

The two lower rows, consisting of 1040 square feet of heating surface, is a crude-residuum heat exchanger, the residuum from the upper row flowing countercurrent to the crude, each liquid passing in parallel through the four rows of tubes in each tube bank.

Metal lath and cement plaster in box shape forms the insulation, which is of air tight construction. No filler is used for insulation around the pipes. The crude is pumped through the exchanger and the residuum flows by gravity.

Data on four test runs are given below. Test No. 1 is on crude-residuum exchange with no steam through the top row. Tests Nos. 2, 3 and 4 are on the residuum-exhaust steam through the top row and crude-residuum through the two bottom rows. The latter three tests show results obtained in varying the quantity and velocity of exhaust steam entering the exchange system, under different pressures and temperatures, as well as variations in the quantity and temperature of crude and residuum entering the system. If the data given in the test tables below is

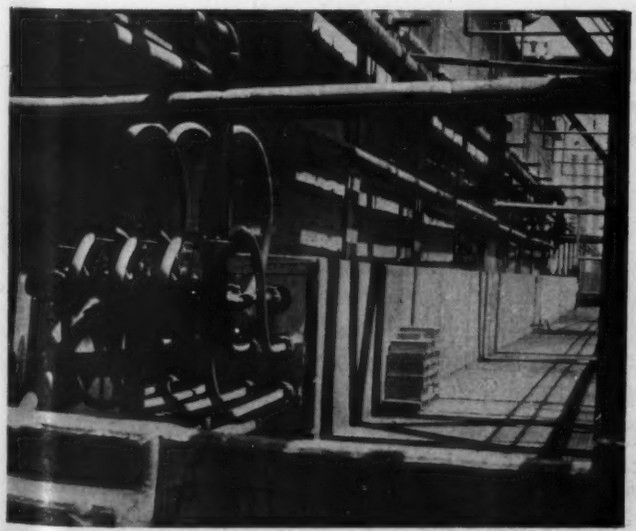


FIG. 1.—*View of completed heat exchanger, showing double pipe construction at one end, and box insulation*

FIG. 2.—*View taken during construction and before insulation was applied*

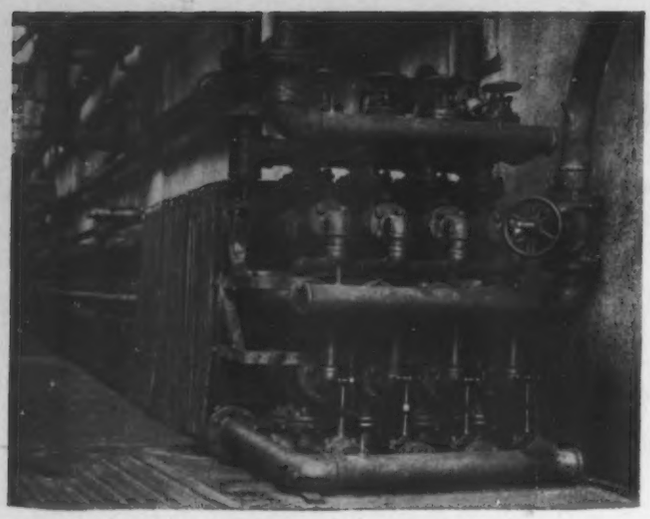


FIG. 3.—*View of anchored end of heat exchanger, showing control valves. Taken during construction, and showing insulation being applied*

studied carefully, the efficiencies obtained by this "home made" heat exchanger are apparent.

TEST NO. 1—Crude-Residuum Exchange—No Steam through top row			
Gravity of Crude	30.6° A. P. I.		
Gravity of Residuum	28.0° A. P. I.		
Quantity Crude through Exchanger	180 bbls. per hour		
Quantity Residuum through Exchanger	132 bbls per hour		
Temperature of Crude, In	158° F.		
Temperature of Crude, Out	282° F.		
Temperature of Residuum, In	438° F.		
Temperature of Residuum, Out	300° F.		
Mean temperature difference	149° F.		
Crude Inlet Pressure	20 lbs. gauge		
Residuum Inlet Pressure	5 lbs.		
Crude Velocity at Mean Temperature	1.5 ft. per second		
Residuum Velocity at Mean Temperature	0.5 ft. per second		
Square Feet of Heating Surface	1040		
Ko (B. t. u. transfer per hour per sq. ft. per degree mean temperature difference)	25		
Total B. t. u. per hour	3,910,000		
Residuum-Exhaust Steam Super-Heater	Test No. 2	Test No. 3	Test No. 4
Residuum through Exchanger, lbs. per hour	160	160	160
Temperature of Residuum, In Top Row	435°F.	435°F.	435°F.
Temperature of Residuum, Out Bottom Row	306°F.	306°F.	308°F.
Exhaust Steam Pressure, In	2136	3026	3700
Exhaust Steam Pressure, In	8.5 lbs.	6.5 lbs.	4.5 lbs.
Exhaust Steam Pressure, Out	5.0 lbs.	2.0 lbs.	0
Exhaust Steam Temperature, In	224°F.	219°F.	214°F.
Exhaust Steam Temperature, Out	346°F.	352°F.	357°F.
Crude through Exchanger, bbls./hr.	203	203	203
Crude Temperature, In	160°F.	156°F.	159°F.
Crude Temperature, Out	283°F.	282°F.	278°F.
Residuum Velocity at Mean Temperature	.5′/sec.	.5′/sec.	.5′/sec.
Steam Velocity at Mean Temp.	20′/sec.	28.5′/sec.	35′/sec.
Mean Temp. Difference, Steam-Residuum	144°F.	145°F.	145°F.
Square Feet Heating Surface, Top Row	520	520	520
Ko (B. t. u. transfer per hour per sq. ft. per degree mean temperature different) in Top Row	3.3	3.2	3.3
Total B. t. u. per hour transferred in Top Row	230,000	240,000	250,000

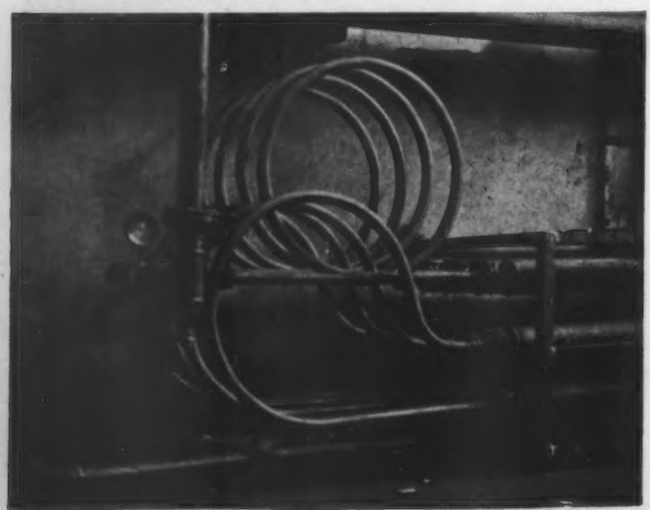


FIG. 4.—*Double pipe bends, unanchored to allow for expansion*

Plant *for* Hydrogenation of Petroleum

By GEORGE REID
Associate Editor

WHEN the Standard Oil Company of New Jersey, in late 1927, reached an agreement with the I. G. Farbenindustrie for a joint research on the latter company's catalytic hydrogenation process, the popular opinion in the petroleum industry in this country was that the New Jersey Standard Group was merely making a far sighted investment and would use its rights only when oil would be made by the liquefaction of coal. Knowledge of Standard Oil Company of New Jersey's experimental and research work at Baton Rouge, Louisiana, (refinery of Standard Oil Company of Louisiana) where a semi-commercial plant has been in successful operation for the past year, was indicative of the American company's determination to perfect its process in this country at once.

The most interesting and most important phase of the New Jersey company's work, however, is that instead of applying the process to the liquifaction of coal, it has perfected the process by application to the hydrogenation of petroleum.

S. D. Kirkpatrick, editor, in the June issue of Chemical and Metallurgical Engineering (Vol. 36, No. 6, Page 332), interestingly sets forth something of the development of the process and its advantages and states that there are almost revolutionary possibilities in the hydrogenation of petroleum. Quoting Mr. Kirkpatrick, "This process, which had been developed by the I. G. Farbenindustrie for German conditions as an outgrowth of coal hydrogenation, has been adapted to the petroleum industry on a commercial scale by the chemical engineers of the Standard Oil Company of New Jersey. By this high-pressure, high-temperature, catalytic process, fuel crudes and the heavy residues of the ordinary refining process can be converted almost quantitatively into gasoline or other valuable petroleum products. A semi-commercial plant has been in successful operation at Baton Rouge, Louisiana, for about a year, and construction is now going forward on the first of two large plants that will compare in output with an average oil refinery.

"In the opinion of those who have closely followed the course of hydrogenation development, this process will take rank as a scientific and commercial achievement along with Baeyer's original synthesis of indigo and Dr. W. M. Burton's introduction of the cracking process to the petroleum industry. Hydrogenation marks the first substantial move toward the application of the basic principles of chemical synthesis in the petroleum industry. Heretofore, in cracking practice, gasoline has been produced by a destructive rather than constructive reaction. Now, by the introduction of hydrogen under pressures upward of 100 to 300 atmospheres and in the presence of a catalyst, it is possible to build up or synthesize the hydrocarbons desired and thus to convert approximately 100 per cent. of the origi-

nal oil into gasoline or other products of more value. Carbon formation is actually eliminated and the production of fixed gasses is reduced to a minimum. Thus the chemical engineer has again demonstrated that in large measure true conservation of our oil resources lies in their scientific utilization. This process alone promises to make more valuable millions of barrels of low-grade fuel oil and refinery residues."

"Starting with the knowledge gained by developments in Germany, further laboratory and semi-commercial plant scale experiments were undertaken by a group of over 150 American chemists, engineers, and skilled mechanics. The group of American workers has co-operated with, and in turn has been greatly helped by, the research and engineering staff of the I. G. Farbenindustrie. The work in this country, however, has been a strictly American development. The plants now under construction utilize what are reputed to be the largest ingot forgings of alloy steel that have ever been fabricated in the United States. These forgings are made by an American firm according to specifications laid down by the development engineers who have studied the high-pressure and temperature requirements of the process.

"The commercial development of the new process is to be carried on by the Standard Oil Company of New Jersey entirely independent of and without any reference to the American I. G. Chemical Corporation. As a matter of fact, neither the Standard Oil Company of New Jersey nor its subsidiary or affiliated companies have any interests in the American I. G. Corporation. Mr. Teagle's position on the board of directors of the American I. G. Corporation is undoubtedly a purely personal interest.

"Reports from Germany indicate that it is confidently expected there that an agreement will shortly have been reached whereby the German I. G. Farbenindustrie transfers to the Standard Oil Company of New Jersey all of its interest in hydrogenation and liquefication of coal, oil and allied products. This agreement will cover all countries in the world except Germany, where the I. G. will retain its hydrogenation rights."

Current reports indicate that in addition to continuation of its work at Baton Rouge on a commercial scale, the Standard Oil Company of New Jersey is also establishing a plant at its Bayway, New Jersey, refinery at present. Operating or processing costs of the new hydrogenation process are reported to be comparatively low, and since the formation of coke is eliminated and fixed gas production is very low and containing in itself some valuable constituents, this development will prove of great interest to the petroleum refining industry.

Large Santa Fe Springs Plant Expands With Field

By BRAD MILLS
Staff Representative

OPERATING one of the largest independently owned natural gasoline plants in the world, The Norwalk Company at Santa Fe Springs, by remodeling its original 30,000-gallon plant and the installation of three 30,000-gallon units, has been one of the chief factors in collecting and treating the tremendous volumes of natural gas produced from this field during the present flood of crude from the deep sand development.

Before the discovery of the Buckbee zone some 10 months ago, the plant was operating on gas produced from the upper zones, namely, the Foix, Bell and Meyer sands, developed during 1922 and 1923. As the pressures on these older wells had decreased and all were being produced either by pumping or gas lifting, it was necessary to collect the gas produced by means of a vacuum system and compress it to 30 pounds pressure in order to treat it.

When it became evident that due to the new development an increased supply of gas would exist, The Norwalk Company immediately commenced the construction of an additional unit. It was contemplated that the volume of gas which would be produced from the deeper zones would be large, but it was not until the first two wells connected to the system came in, one making 8 million and the other 22 million cubic feet of gas per day, that it was realized that the volumes which would be produced were beyond all expectation.

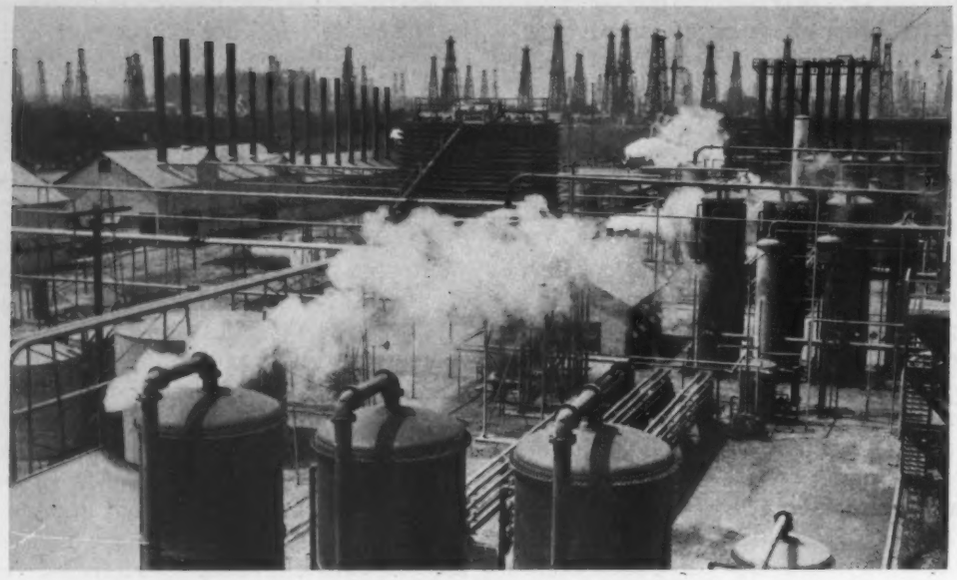
Whereupon a second new unit was commenced and before its completion, so great had the gas volume become, a third unit was started and rushed to completion.

Also, during this time the field gathering system was completely remodeled and additional mains laid in order to collect this gas and transport it to the plant as efficiently as possible.

In March, the four units of the plant handled 126 million cubic feet of gas per day, from which 140,000 gallons of specification gasoline was recovered. The Buckbee, Nordstrum and O'Connell zones are producing a comparatively lean gas, though at present somewhat richer than during the peak of February and March. The volume was high and the gasoline content rather low, making an efficient layout essential to economical operation.

OPERATION METHODS

The three new units are almost identical in construction and were designed to operate with the greatest degree of flexibility. The field and gathering line pressures make it unnecessary to use com-



Norwalk Plant from the Cooling Tower

pressors with these units, the gas entering the system with a minimum of effort. The rapid development of the lower sands has made precaution necessary, particularly with reference to cleaning the gas and rectifying the absorption oil.

In describing the flow of the gas, only one of the three new units will be considered. The capacity of each is practically the same but no two are treating nearer than approximately the same quantity. Field and plant conditions govern the quantity each treats daily.

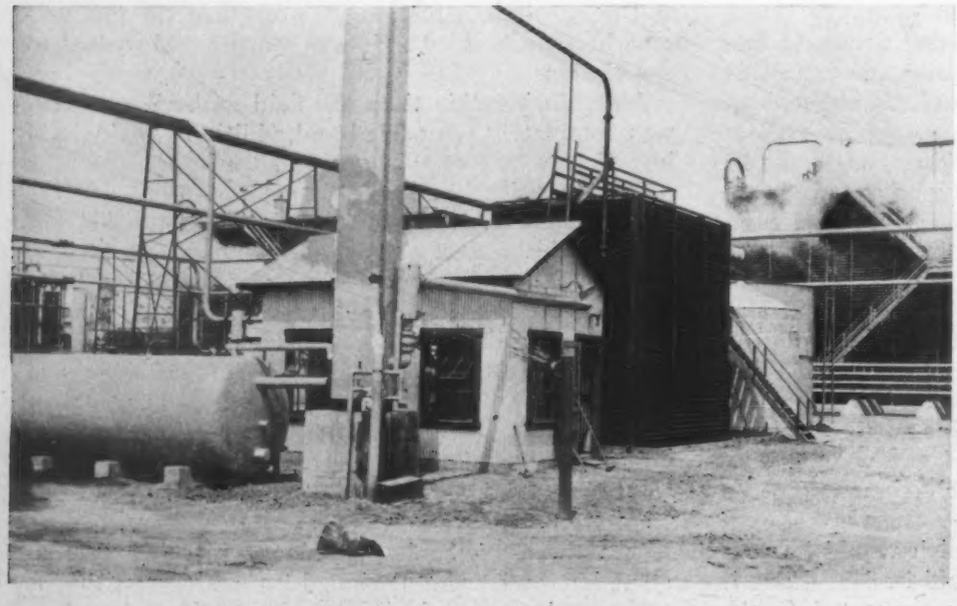
The gas enters the plant from the field gathering lines at about 45 pounds pressure. Crude mist which invariably contaminates gas produced under peak conditions is successfully removed by means of large scrubbers designed for this purpose. These scrubbers are equipped with ingeniously designed baffles which cause the gas to change the direction of flow many times on its passage through. These baffles present a rough surface to which the water, oil and foreign matter contained in the gas cling and which drip into the base of the scrubber and are removed.

The scrubbed gas then passes to three perforated plate absorbers connected in parallel, each capable of handling 12 million cubic feet of gas daily.

Dry gas from the absorbers then passes through a dry gas scrubber for the purpose of removing any entrained absorber oil. The saturated oil leaving the absorbers enters three heat interchangers connected in parallel. The oil is heated at this point from an initial temperature of around 100 degrees F. to 280 degrees F.

THREE PRE-HEATERS

After leaving the interchangers the oil is further heated by means of four steam preheaters, also connected in parallel, thus bringing the temperature of the fat oil up to 350 degrees F. before entering the still. The steam preheaters are elevated to a point which allows the condensed steam to flow directly from the bottom of the shells back to the boiler plant, thus making their operation efficient and economical. With this type of installation a very small amount of make-up water is required in the boilers furnishing steam for heating. Scale deposit on the tubes is thus reduced to a minimum. Water from the preheaters enters the boilers at about 325 degrees F., which is considerably higher in temperature than could be obtained by means of a feed water heater.



Complete plant for cleaning and reclaiming absorption oil

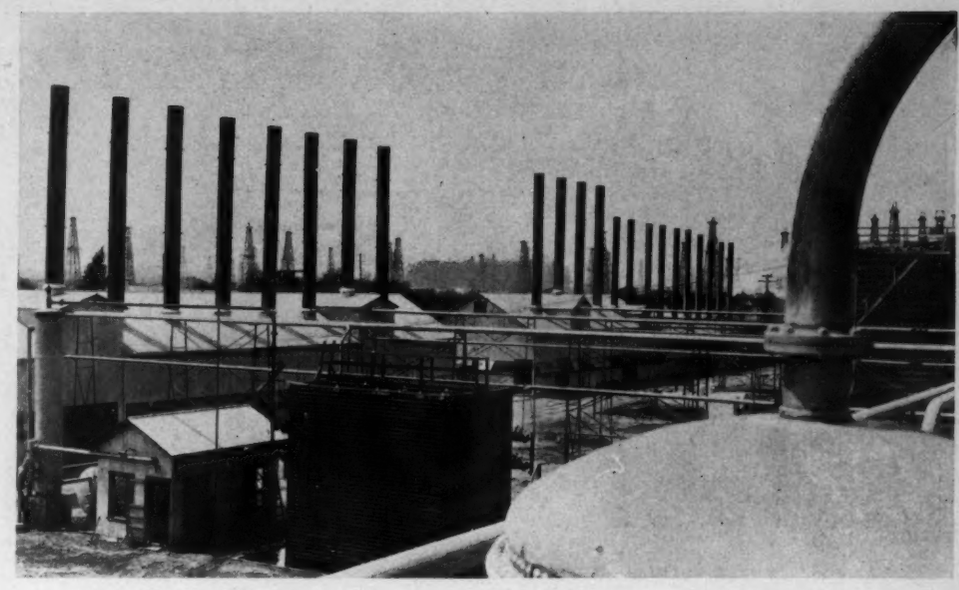
Heated fat oil from the preheaters enters the still or stripper, at which point the gasoline vapors are removed. The live steam used for agitation in this still is obtained from the exhaust from the fat and lean oil pumps.

Vapors leaving the still pass through a dephlegmator located

at the top of the cooling tower and designed in such a way that the large volume of heat liberated in the dephlegmator cooling is dissipated without interfering with the remainder of the cooling tower operation.

The vapors leaving the dephlegmator pass through a mist extractor, thence to the fractionator which is operated at a temperature slightly below that of the dephlegmator and into which a small volume of finished gasoline is automatically introduced as reflux. By this means the end point of the finished gasoline is automatically controlled.

From the fractionator the vapors pass through cooling coils in the cooling tower, the water from the condensate being collected and drained by means of a de-watering tank. Residue from the fractionator passes into the suction of the fat oil pumps.



Boiler arrangement

The gasoline from which the moisture has been removed passes to the rectifier which is operated at a pressure of 150 pounds and a temperature of 230 degrees F., the conditions necessary to produce a product of the required recovery. The finished gasoline from the rectifier is cooled by means of coils in the cooling tower and passes on to the storage tanks.

Vapors from the top of the rectifying column are cooled and partially condensed in the cooling tower and the condensate is used as reflux in the rectifier. Those which are not condensed pass through a small reabsorber on their way to the dry gas line.

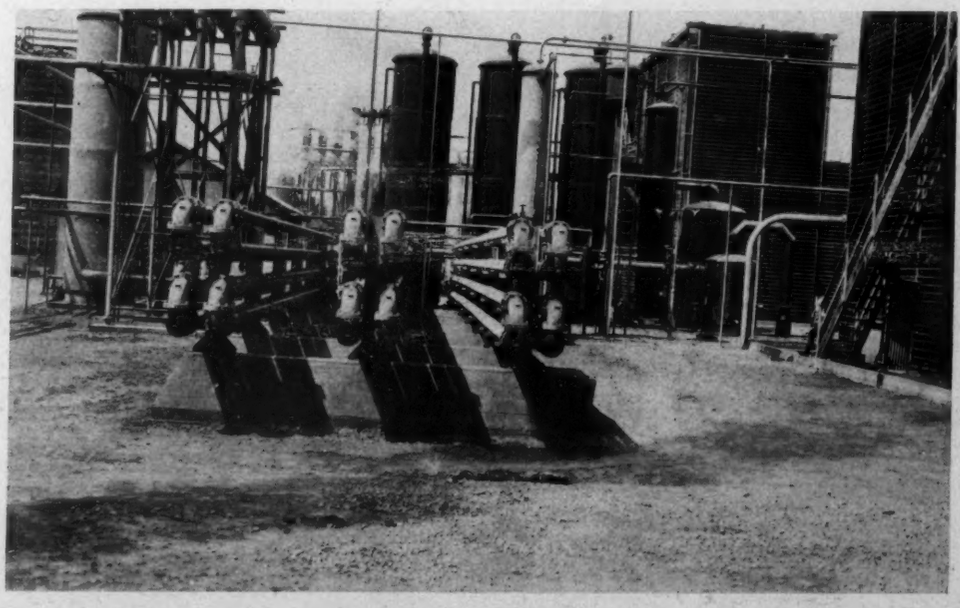
An oil circulation of from 550 to 570 gallons per minute is maintained.

Each of the three new units is operated as a separate plant, having its own pumping equipment, boiler unit and cooling tower. The pumps for each unit include two 12x8½x12 of the Duplex type for the lean oil and two of the same size and type for the fat oil and a fifth pump used as a spare for either the fat or the lean oil. Three 7½x8½x10 Duplex pumps are used for the circulation of water.

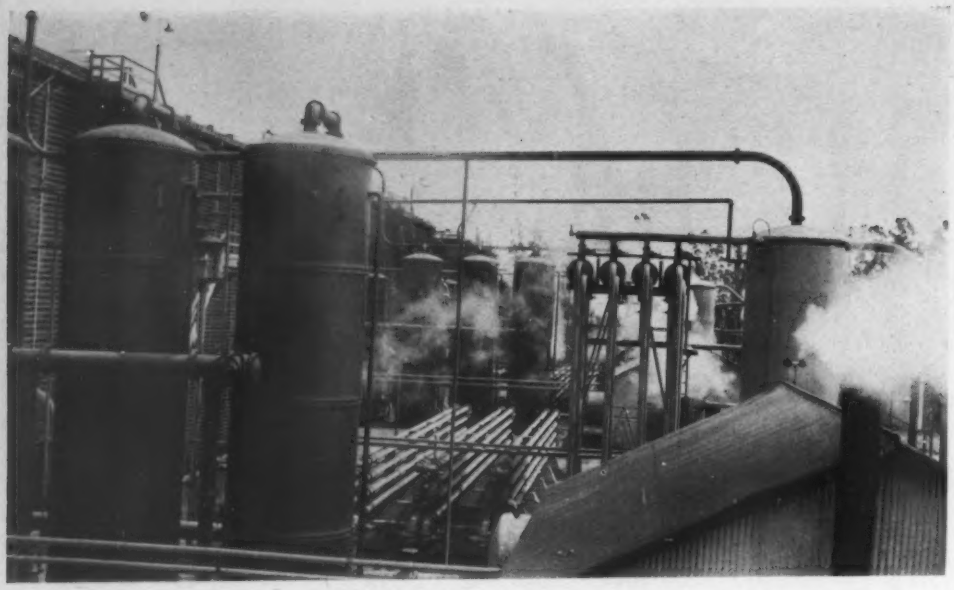
These three units are at present handling a total of 62 million cubic feet of gas per day, and were built by the J. A. Campbell Company.

The original unit is being used to treat gas received from the low pressure system. This low pressure system is maintained at a vacuum by means of eight 160 H. P. Western gas engine driven Ingersoll-Rand compressors which comprises the original installation and also a new installation consisting of eight 170 H.P. direct connected Cooper compressors. The eight Cooper compressors mentioned have just been installed and are of the latest type developed by the manufacturers. The low pressure gas from the field is compressed to 30 pounds which is sufficient to carry it through the plant.

After being compressed the gas is cooled by means of closed type coolers and enters two perforated plate absorbers which are at the present time operating under a load of about 15 million cubic feet per day. Gas entering these absorbers is considerably richer in gasoline than the gas obtained from the high pres-



Partial view of one unit



End view of one unit

sure system as this gas is produced in the field from the original shallow sand wells and also from a number of low pressure trap installations on the new wells.

The oil circulation on this unit is 450 gallons per 24 hours and due to the richness of the gas treated becomes quite highly saturated. This fat oil passes through the heat interchangers, thence to steam preheaters elevated to return the condensed steam directly to the boilers, and the preheated oil then passes into a fractionating still of the latest design. In this type of still a portion of the finished product is used as reflux; the vapors leaving the still after being condensed and cooled are end point gasoline.

This gasoline is then rectified by means of a low pressure rectifier and the finished product is cooled and delivered to storage.

Vapors leaving the top of the rectifier are re-compressed and after cooling the condensate is returned to the rectifier as reflux.

The lean oil leaving the still passes through the heat exchangers to the enclosed pressure surge tank where it is picked up by the pumps and cooled by means of coils installed in the cooling tower. The operation of the cooling tower in this plant presents a novel arrangement. The tower is divided into two sections, one for the initial oil cooling and one for the final oil cooling. The basin is also divided, the water from the hot side of the tower being used for cooling the engine jackets. That from the cool side is used for the final cooling of oil. The cooling water used for gas and gasoline cooling is supplied by a small auxiliary cooling tower.

Water obtained from water wells drilled in Santa Fe Springs as a rule contains a comparatively high concentration of salts, but The Norwalk Company has been fortunate in obtaining a supply of water from their well which is very susceptible to lime treatment. Consequently, the water from the hot side of the cooling tower and used as engine jacket cooling deposits very little scale and no trouble is experienced from this source.

CLEAN ABSORPTION OIL

An added feature of this plant and one that materially reduces the cost of operation is an absorption oil cleaning plant. This plant is complete within itself and is used for the purpose of redistilling the absorption oil when necessary.

Feed pumps supply most of the agitation steam to this still, a slightly additional amount being necessary from the main steam line.

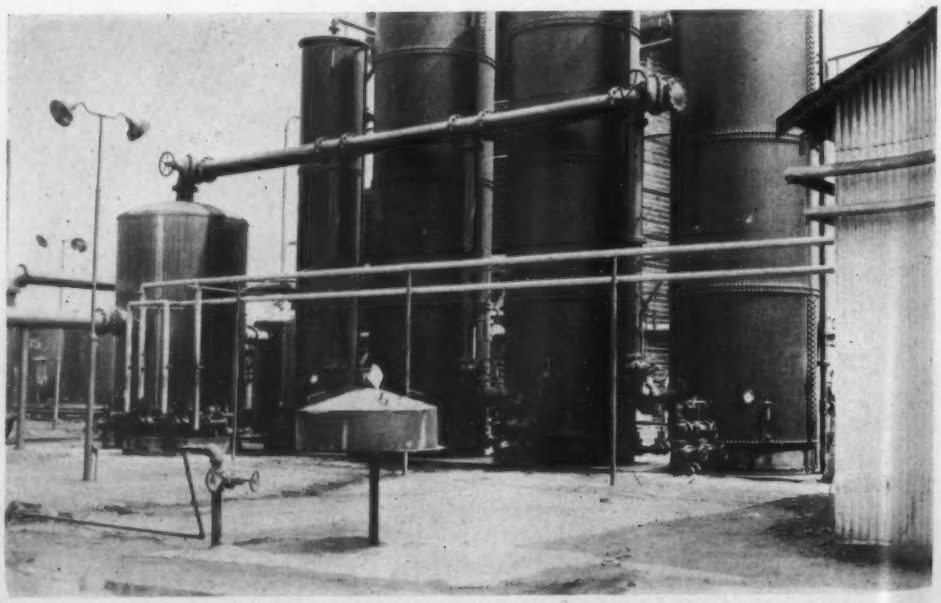
Oil and water vapors leaving the top of the still pass through a small cooling tower, are condensed, the water removed and the oil delivered to the clean oil storage.

The still bottoms pass to a surge tank and are recycled with the oil entering the retort until this product becomes too heavy for use.

Although this unit has been in operation but a short time it is believed that it presents a worth while investment.

The boiler plant supplying steam to this 4-unit absorption plant consists of 12 150 h.p. and 10 70 h.p. horizontal return tubular boilers totaling 2500 boiler h.p. The boiler plant is arranged so that each unit has its own series of boilers.

The plant has been designed to operate under varying conditions and is expected to be a major factor in the production of natural gasoline in California for many years to come.



Close up of absorber installation in one of three new units

Some Facts About Pumps and Pumping

By H. L. KAUFFMAN

A PUMP may be defined broadly as a machine for the transportation of liquids or gases from one location to another through pipes. To accomplish this result, the principles of suction and forcing may be used; in practice, generally, a combination of the two. Pumps are probably the most essential single item of equipment necessary for the production, transportation and refining of petroleum and its products.

Pumps may be divided into displacements types, either steam or power-driven; and centrifugal and rotary types that may either be direct-connected to or belt-driven from a prime-mover or line-shaft. A more specific outline of the different kinds of pumps is to classify them as follows:

1. *Piston pumps,* in which a plunger moves the fluid and puts pressure behind it.
2. *Positive displacement rotary pumps,* in which a rotating impeller or screw imparts motion and pressure to the fluid.
3. *Centrifugal pumps,* in which pressure and velocity are imparted to the fluid by a rotating fan or wheel.
4. *Direct-pressure pumps,* in which pressure is transferred from one fluid to the surface of another fluid.
5. So-called *"jet-pumps,"* in which the momentum of a jet of fluid gives velocity and pressure to a stream.

PISTON PUMP

The piston pump is a comparatively simple and sturdy piece of equipment. Usually, the steam piston is directly connected to the liquid plunger by means of a rod moving through stuffing-boxes. Piston pumps operate on steam at the boiler pressure and, consequently, with few exceptions, fail to utilize the expansive energy stored in the steam. However, those types that do utilize this energy are fitted with fly-wheels, the energy stored in the moving fly-wheels permitting the variable steam pressure. Because of lost motion in the valves, piston pumps do not have so-called "dead centers;" in other words, it is impossible so to stop them that they will not start when the steam is again "turned on."

Air-chambers are a necessary feature of piston pumps in view of the fact that there is a constantly changing pressure. Irregular pressure causes both acceleration and retardation to take place in the stream of liquid being pumped and a considerable amount of energy to be lost due both to inertia and to loss of momentum. However, if air-chambers be placed in the discharge line, such chambers will tend to act as "buffers" and will serve to equalize the pressure. Liquids are non-compressible and, therefore, will transmit any pressure placed upon them; air and other gases, on the other hand, are readily compressed and hence take up the shock that otherwise would result from sudden pressure changes while pumping. In action, the air in the air-chamber is compressed, as the pressure increases, and regains its normal volume when the pressure again decreases. In expanding, the air in the chamber exerts pressure upon the liquid in the pipe and thus keeps the velocity of flow fairly uniform. The size of the air-chamber for a particular pump-system is chosen so that the pressure head in it remains almost unchanged. In simplex pumps, the air-chamber is about three times the volume of the liquid piston-displacement; in duplex pumps, it is about twice the piston-displacement, this difference being due to the fact that the discharge from a duplex type of pump is so much more steady than that from a simplex pump.

Steam-driven displacement (piston) pumps of either the single or duplex types are of low first cost, simple in construction (and, therefore, trouble symptoms are easily diagnosed and the necessary repairs readily made) and are unequaled in their flexibility as to speed, capacity and their ability to handle either light or heavy oils against any discharge pressure up to the maximum for which their liquids-ends are designed. This type of pump, is especially satisfactory for handling small quantities of liquids against high pressure heads; and small quantities of liquid containing gases, or liquids at pressures and temperatures at which they readily give off vapors, against negative suction heads. When the service so requires, steam-driven piston pumps may be automatically controlled by suitable speed and pressure governors. Such pumps may always be protected by an excess pressure governor from any damage that would result from the sudden closing of the discharge valve.

Power-driven displacement (piston) pumps of the single, duplex or triplex types are highly efficient machines, although their initial cost is higher than that of either steam-driven displacement or centrifugal pumping-equipment. Such pumps are suitable for a wider range of operating conditions than centrifugal pumps and, when driven either by variable-speed DC motors or by recently-developed, variable-speed AC motors, they are quite flexible in their operation.

ROTARY PUMPS

Rotary pumps are of two general classes:

1. Gear or cyclodial pattern.
2. Rotating piston pattern.

The simplest type of gear pump consists of two spur gears, meshed closely, and enclosed in a case that also fits closely to the sides and outer faces of the gears, but leaves a clearance in the triangular

spaces between them. One of these spaces is connected to the suction, the other, to the discharge end of the pump. As the gears revolve together, liquid flows into the space remaining between the teeth and the rim of the case and thereupon is carried to the discharge side. In view of the fact that additional quantities of liquid are constantly being brought to this side and since, due to the meshing of the teeth the liquid can not flow back to the center, the fluid is forced out of the discharge port.

In the cyclodial pattern, a modified gear that has an in-curved blade like the teeth of a circular saw is used. The tip of one blade, as it revolves, sweeps the inner surface of the opposite tooth. The advantage of the use of this type of gear is that larger pockets are obtained in relation to the weight of metals in the rotors. These gears will not revolve each other and, for that reason, a pair of spur gears outside the case must be provided in order to hold them in their proper, relative position.

The advantage of the gear type of pump are as follows:

1. It is readily driven by power.
2. It is very light and comparatively inexpensive.
3. It gives an absolutely regular and pulseless discharge.

The main disadvantage is:

1. Clearances rapidly increase, due to cutting of the rubbing surfaces by grit contained in the liquid being pumped; and as there is no "take-up" for wear, these pumps wear out very rapidly.

The rotating piston type of rotary pump consists of a cylindrical drum, with a revolving shaft of large diameter running lengthwise. A vane as long as the drum and as wide as the diameter slides freely through a seat in the shaft, which is set close to one side of the barrel. As the shaft revolves the vane sweeps both sides, so that the space remaining on one side is alternately increased and decreased. The suction in-take is on the wide side; the discharge, on the narrow side. The advantage of the vane type of pump is that allowance is made for wear by providing for the use of wider vanes and for re-lining the barrel.

CENTRIFUGAL PUMPS

Centrifugal pumps are highly efficient machines for pumping water, light distillates and crude oils of low viscosity. Motor-driven centrifugal pumps are constant-speed machines of fixed head capacity characteristics. The speed of steam-turbine-driven centrifugal pumps can be changed, giving the pump some flexibility but to an extent that can not be compared with that of the steam-driven displacement pump. A centrifugal pump that has been designed for handling water or light distillates will not handle heavier oils with any degree of economy and, in many cases, will not handle such oils at all. This type of pump if properly designed will not damage itself or its motor should the discharge valve be closed before the pump is shut down. As compared with the reciprocating pump, the motion of the centrifugal pump is that of rotation instead of reciprocation or oscillation and thereby is avoided the disadvantages of constantly reversing the motion of heavy parts. Further, when centrifugal types are being used, one is given definite assurance that the discharged fluid is moving in a smooth, continuous stream. For intermittent service and especially where steam is not readily obtainable, motor-driven centrifugal pumps are to be preferred for handling certain fluids. Such pumps have few parts, no valves, give a uniform pressure and flow and have a relatively low first cost. However, for heavy duty and for high pressures, piston pumps—in spite of their wastefulness of steam and low efficiency—are considered to be more dependable than any other type.

TYPES OF REFINERY PUMPS

Oil-refinery pumps may be divided, broadly, into two general groups:

1. Water pumps.
2. Oil pumps.

Water pumps include general water-supply pumps, booster pumps, power auxiliary pumps, and fire pumps. Both reciprocating and centrifugal pumps are used for the above-mentioned purposes, with the advantages probably "weighing" more in favor of the centrifugal.

Under the heading of "oil pumps" may be considered two general divisions:

1. Cold-oil pumps.
2. Hot-oil pumps.

The division may be made reasonably at a point where liquids at a temperature of over 500° are to be handled; for it has been found necessary in pump-construction at this temperature and above to use materials and methods that are not necessary when oils at a lower temperature are to be pumped.

Pumps capable of handling so-called "cold oils" have been discussed in preceding paragraphs. The hot-oil pumps in use are of several commercial types as, for example, the centrifugal, positive displacement and surge types. There are at least a half dozen different kinds of hot-oil pumps that will pump oils at a tempertaure as high as 1000° under pressure.

SELECTION OF PUMPS

No fixed rule can be made to govern the selection of pumping equipment. Each case must be considered by itself and a selection made that will give the most efficient and economical unit for that service.

In an oil refinery all types of pumps are used. Here the selection does not depend solely upon the service that the pump is to perform, but to a great extent also upon operating conditions within the refinery itself. If the amount of exhaust steam from the main and auxiliary refinery equipment does not provide a sufficient quantity for process work, steam-driven pumps will be the most economical type. The cost of operating steam pumps under these conditions is a relatively small item of expense; for the pump simply acts as a reducing valve and the useful work performed becomes a by-product of the steam generated for process work.

Steam-driven displacement pumps will always be

the most satisfactory type for use if one pump alone must handle both light and heavy oils or any grade of oil over a considerable range of capacities and pressures. If the amount of exhaust steam exceeds the process requirements and if electric current is available, either power-driven displacement pumps or centrifugal pumps may be used to advantage to supplement the steam-driven pumps.

When bleeder-type turbines are used for driving the main generators, steam for process work is taken from the intermediate stages of the turbines. In this case the electric current becomes the by-product and is used to drive the pumping equipment. Power-driven displacement pumps and centrifugal pumps are used almost exclusively under such conditions, steam-driven pumps then being used only when the service conditions can not be met by other types.

If a pump is required to operate against a high pressure with the minimum of pulsations in the discharge line (for example, when pumping chilled wax-distillate to a wax-press where a smooth flow is of utmost importance), the triplex single-acting power pump will give the best results.

Centrifugal pumps will prove the most economical type to use in many places around the refinery for pumping water and liquids of similar viscosity and for pumping gasoline, kerosene and other light distillates and oils of low viscosity to the loading racks.

FACTORS AFFECTING PUMP CAPACITY

The theoretical discharge of a plunger pump is the volume displaced by the plunger per stroke multiplied by the number of strokes per minute. The actual discharge may be either greater or less than this amount. The ratio of the "actual discharge per stroke" to the "volume displaced by plunger per stroke" is called the coefficient of discharge of the pump: the difference between these quantities is called the slip. If the actual discharge is less than the theoretical, the slip is said to be positive; if greater, it is said to be negative. Positive slip is due to leakage past the valves and plunger. In a steady working pump with valves in proper condition this slippage should be less than 10 per cent., although in a new pump it is seldom more than 1½ to 2 per cent., same referring to a percentage of the displacement.

If it is known how much liquid is to be pumped in a certain length of time and at what pressure it must be pumped, the capacity of the piston pump required to pump the necessary amount of fluid can be calculated by the use of the following formula:

Capacity of pump in gallons per hour equals $0.204\ N\ d^2\ L$;

where N equals number of single strokes per minute.

d equals Diameter of liquid plunger in inches.

L equals Length of stroke in inches.

However, the actual capacity will be from 60 to 95 per cent. of the figure given by the use of the above formula, this depending upon the tightness of the piston, condition of valves, length of suction pipe, etc.

EFFECT OF LENGTH OF SUCTION PIPE UPON PUMP

The length of the suction pipe, or more exactly, the distance above the normal level of the liquid that the pump can lift the liquid by suction has a definite limit, above which the pump can not operate. This length is equal to the height of a column of the liquid, the pressure of which at the base of the column is the same as the atmospheric pressure less the loss in head due to friction in the pipe itself. Depending upon the altitude, the atmospheric pressure existing most generally in the United States will be between 14 and 15 pounds per square inch. This corresponds to the pressure of a column of water about 30 feet high. No matter how great a vacuum is obtained, it is impossible to lift water by suction over this height above the normal water-level. The height to which other liquids can be lifted depends upon their specific gravity; for example, strong sulfuric acid could not be lifted above a height of about 16 feet.

In actual pumping operations, the distance of the center of the pump above the normal water-level is scarcely ever more than 10 to 12 feet. Frequently, the pump suction is below the normal level in which case it is said to be "flooded." The only limitation on the horizontal length of the suction pipe is loss of head due to friction. If the sum of the loss of head and the height lifted is greater than the atmospheric pressure, the stream of liquid in the suction pipe will separate and no liquid will enter the pump.

In operation, piston pumps merely transmit pressure from the pressure-source (steam, compressed air, gas, or whatever the source of pressure may be) directly to the liquid to be pumped. If the heads of both steam piston and liquid plunger are of the same size, the pressure will be transmitted unchanged; but if the area of the plunger head is less than that of the steam piston, the pressure will be stepped up proportionately. Pump dimensions are stamped on all piston pumps: 4x4x6, meaning that the diameter of the steam piston is four inches, the diameter of the plunger head is four inches and the length of the stroke is six inches.

CARE OF PISTON PUMPS

Three main points are to be noted in the care of piston pumps:

1. Packing in the stuffing boxes should be kept tight.
2. Pumps should be kept well lubricated.
3. Pumps should never be "raced," for so doing not only injures the pump, but gains nothing in pressure or in rate of discharge.

Table 1 shows piston speeds in feet per minute for direct-acting pumps, same being based on average conditions of installation.

PISTON PUMP EFFICIENCY

Volumetric efficiency (slippage) is expressed by the equation E^v equals $\frac{D}{d}$, where D equals the volume of liquid discharged and d equals plunger displacement. The use of the term *hydraulic losses* has

TABLE 1
Piston Speeds in Feet Per Minute for Direct-Acting Pumps
(From Worthington Pump Handbook, Sec. V, 73)

Strokes in Inches	General Service	Light Heads Low Service	Boiler-Feed	Pressure Pumps
3	28	25	18	20
4	33	30	22	24
5	38	34	24	26
6	40	36	26	29
8	47	43	30	33
10	58	52	38	42
12	60	54	39	43
15	75	68	49	54
18	90	81	59	65
24	100	90	65	72
36	120	108	78	86

For emergency service, the speeds given in Table 1 may be increased 30 per cent.

reference to those losses of head that occur when the liquid passes from the suction-well to the pump-chamber and from there to the discharge nozzle. Such losses are chiefly due to friction and to the pressure of the valve-springs. *Hydraulic efficiency* is expressed by the equation

E_h equals $\frac{T}{H}$, where T equals the total head pumped against and H equals T plus hydraulic losses.

the indicated efficiency of a piston pump is the ratio of the power developed in raising the liquid to the power developed in the pump end. It is also the product of the hydraulic efficiency and the volumetric efficiency and is expressed by

E_i equals $\frac{HP_{liq}}{HP_i}$, where HP_{liq} is the horsepower developed in raising the liquid and HP_i is the horsepower developed in the pump-end (as shown on indicator diagrams); also E_i equals $E_h \times E_v$, where E_h and E_v have the same meanings as given above. The mechanical efficiency of a piston pump is the ratio of the power developed in the pump-end to the power developed in the steam-end and is expressed by

E_m equals $\frac{HP_{p.i.}}{HP_{s.i.}}$, where $HP_{p.i.}$ equals the horsepower developed in the pump-end (as shown on indicator diagrams) and $HP_{s.i.}$ equals the horsepower developed in the steam-end (likewise as shown on indicator diagrams). The total efficiency of a pump takes into consideration all the losses incurred in the driving mechanism and the pump, and is an indication of the economy of the pumping device as a whole. Where E_h, E_v and E_m have the same meanings as given above, total efficiency is expressed by the following equation:

E equals $E_h \times E_v \times E_m$

State Gasoline Corporation Adds Third Long Beach Plant

STATE Gasoline Corporation has added its third natural gasoline plant in the Long Beach and Alamitos Heights fields, California. The new plant, which was erected in 27 working days in the Signal Hill section of the Long Beach field, incorporates some interesting features in its construction and operation. With an average daily production of 20,000 gallons during the first month of operation the plant was using gas from only three wells producing from the Long Beach deep zone. All of the gasoline production is stabilized, and all gas treated is scrubbed thoroughly by special types of cleaning devices.

Entering the plant, which is of Campbell "Oil Froth" type the wet gas is passed through a large Mist-D-Fier placed on the suction line to compressors where the foreign matter, such as crude mist, water, etc. is removed. A second mist removing device is placed on the gas outlet line leaving the plant where any entrained absorption oil is removed. A third and similar device is employed for cleaning the exhaust steam from pumps prior to its entry into the evaporator and so furnishing a dry steam free from lubricating oil. The effectiveness of such cleansing devices is attested by the fact that the absorption oil in the plant system after the first month of operation showed no discoloring.

Another interesting feature of this new plant is found in the design of the reflux heater. This apparatus receives the reflux material from the dephlegmator after it leaves the duplex dewatering tank and heats it to the same temperature as that of the oil leaving the preheater equipment. This practice eliminates any chilling of the absorption oil and makes possible an increase in temperature of five degrees for the oil leaving the stripper or still.

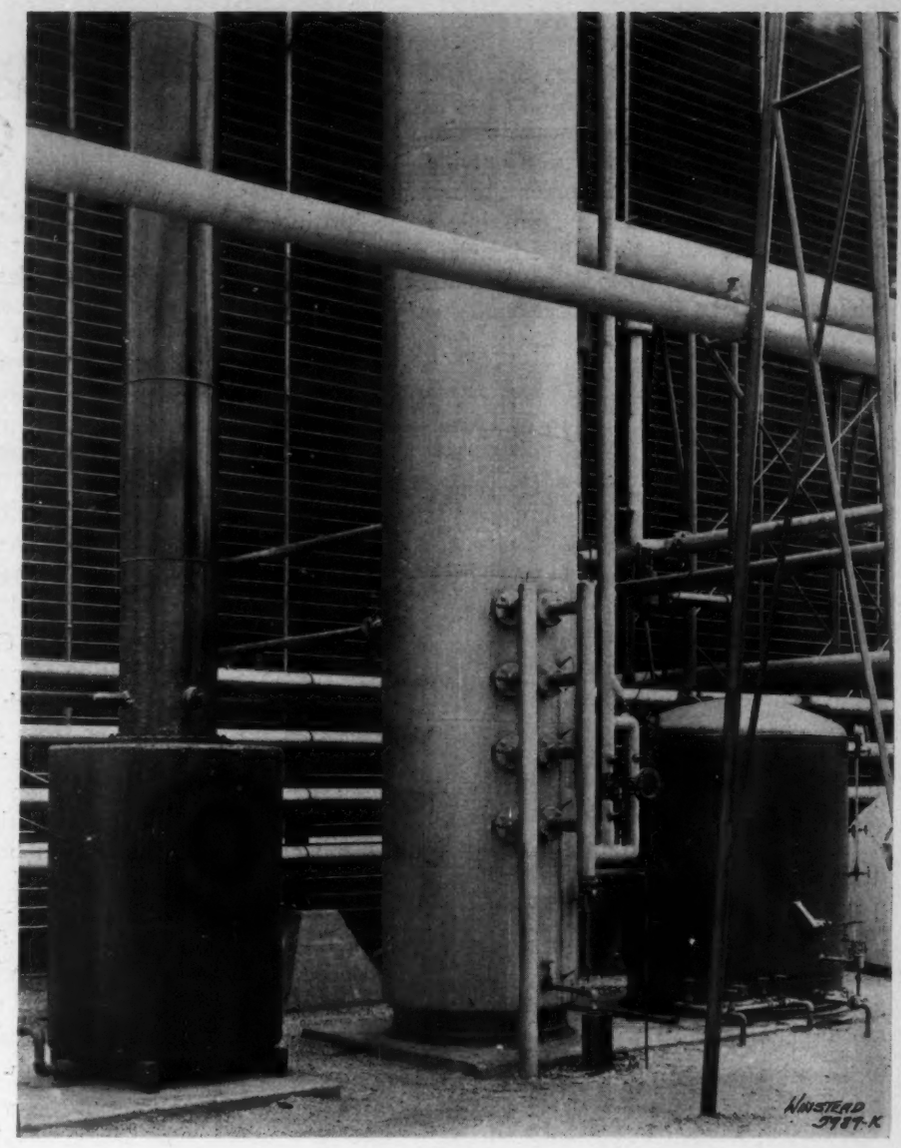
The cooling plant embodies a decided change in handling the spray system in the cooling tower in that the sprays are turned up instead of down. The water falls upon three closely spaced decks. Under this practice the water vapor is liberated in the upper part of the tower and prevents such vapor being drawn down into the main body of the tower by induced draft. During the first 30 days of operation, the oil in the absorbers averaged 68 degrees F. Gas cooling and compressor jacket water cooling is all handled in the same cooling

tower along with the absorption oil and gasoline cooling.

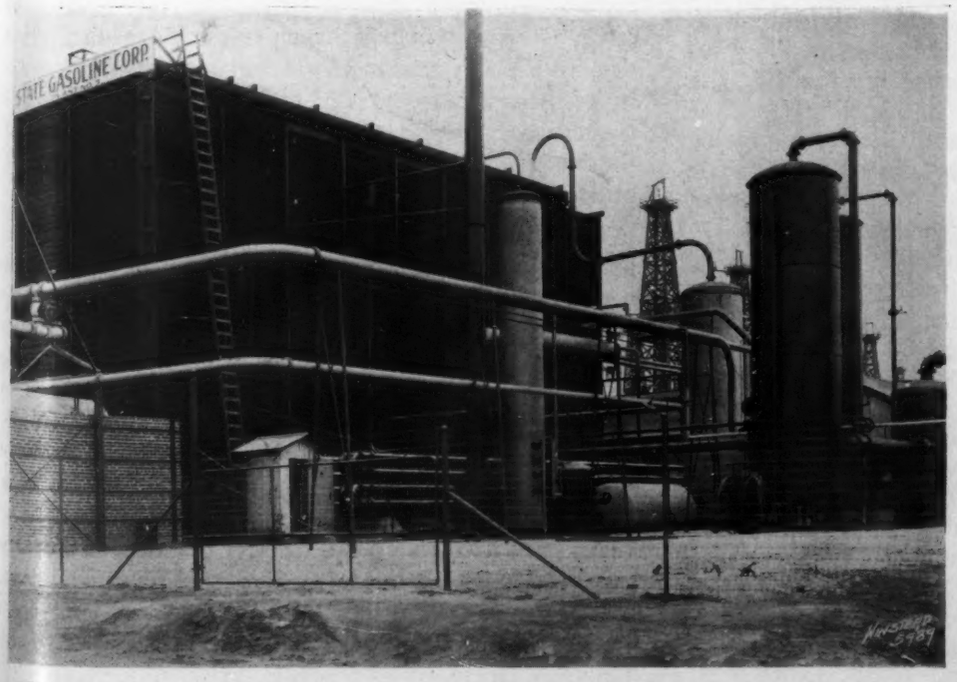
Dry gasses from the auxiliary absorber and reflux heater are ejected through a concrete silencing box, which also serves as a boiler blow-off box. A fourth and smaller Mist-D-Fier is installed in the 18-inch stack leading from the blow-off box to the air where it serves to throw back water when boilers are blowing down. All three boilers may be blown down at the same time without losing any water through the stack. Steam for the absorption plant is furnished by three 150 horsepower boilers with double steam headers. One supplies pumps and the other steam header supplies the elevated preheaters. Through the elevation of the preheaters it is arranged that all condensate is returned direct to the boilers by gravity.

The plant is as near automatically controlled as is possible and requires no attention from the operators other than supervision and the switching of gasoline run-down tanks. Storage consists of two 20,000-gallon vertical tanks, surrounded by a concrete fire wall, with the capacity inside of the fire wall being 150 per cent. of the total storage. The compressor plant consists of four 160 horsepower Ingersoll-Rand direct connected machines. The complete plant installation occupies an area of 125 by 150 feet and is so compact that there is much space to spare.

Another of the interesting features at this plant is the new type stabilizer, for which application for patents has been made. This column incorporates certain changes in design. It is divided into three parts, each having a separate function. The bottom four plates constitute the stripping section; the next six plates are in the production wash section, and the top eight plates constitute the reflux wash section.



Details of steam distribution arrangement to multiple coils in stripper section of stabilizer. Valves are provided for control of each coil and thermometer for indicating temperature



General view of State Gasoline Corporation's newest installation at Long Beach, showing absorption plant lay-out and compactness of design

Each plate of the stripping section has a heating coil which serves to heat gasoline in that section and permits it to overflow into a perforated pan, which, in turn, breaks it up into over 2000 streamlets that splash into the coil-filled pan below.

These steam coils are fed by a main steam header, provided with a valve controlling each coil and all discharging into one header. Through manipulation

of the inlet valves on each coil, a uniform temperature gradient is established across the coils.

This method of heating differs from former practices whereby all of the heating was done in the base of the column or in a reboiler section outside of the column. The operators state that under the method of heating employed by them, namely, multiple stage heating in separate coils, but little of the heavier and more desirable fractions are driven off to ascend into the column where they must then be fractionated and brought back down into the heating section. By means of the multiple-stage (gradual and successive heating) a minimum of the heavier fractions is liberated to pass upward into the tower, which tends to greatly reduce the work imposed upon the equipment.

All of the plant production, after being dewatered and separated from the uncondensed still vapors in the duplex dewatering tank, enters the fractionating column on the sixth plate and works down through the positive seal perforated plates to the stripper section. Vapors liberated in the stripper section wash up through the six "production wash" sections and then up through the eight reflux wash sections, thence into the reflux condenser. This is a set of coils located near the top of the cooling tower. The condensate from the reflux condenser, which under normal operation amounts to about 25 per cent. of total production, is separated in a trap from the uncondensed still vapors upon emerging from the after-cooler coils. It is then admitted to the top plate of the fractionator as reflux wash.

REABSORBER

Uncondensed vapors leaving this trap join the uncondensed still vapors from the duplex dewatering tank and pass into the auxiliary absorber where they are washed with cold oil and any retained desirable fractions are re-absorbed. Fat oil from the auxiliary absorber is conducted back into the main oil circuit lines and into the still or stripper.

Since the volume of gas passing through the re-absorber is only a small portion of the wet gas handled, only 20 gallons of oil per minute for a 20,000-gallon gasoline plant will give a gas-oil ratio of 100 gallons per 1000 cubic feet of gas treated in this auxiliary recovery equipment. The re-absorber is provided with cold lean oil through a by-pass line leading from the main lean oil circuit. Such installations are proving popular with West Coast operators, since they eliminate the employment of recompression for reclamation of valuable hydrocarbons in the uncondensed vapors.

Plant production at this new installation is averaging 87 A. P. I. gravity gasoline with a recovery of 92 per cent. The finished product contains only seven-tenths of one per cent. of propane, but has 33 per cent. of the butanes. It has an initial of 58 degrees F. and recovery of 50 per cent. at 110 degrees F.

The dry gas leaving the main absorber shows only .02 of a gallon of iso-pentane and the gases leaving the auxiliary absorber contain only 0.10 of a gallon of these same constituents. These results were obtained by running actual dry-gas fractionations with the Podbielniak apparatus. The dry gas leaving the auxiliary absorber measure only 208,000 cubic feet per day, showing a loss of only 20 gallons out of a production of 20,000 gallons.

Arizona Batch Plant Converted

RIO Grande Oil Company has completed improvements at its Peoenix, Arizona, refinery and one of the last batch plant operations in the United States is now converted to continuous distillation methods with latest type of bubble tower equipment. Rio Grande operates a 5000-barrel plant at Vinevale (Los Angeles, County) California, where it is erecting two Jenkins cracking units, and a 3000-barrel refinery at El Paso, Texas, which has also been recently reconditioned and improved. The Arizona plant enjoys the distinction of being the only refinery in that state. Formerly there were two refineries in Arizona, but about three years ago the old Apache plant was dismantled and converted into a bulk distributing station.

At the Rio Grande plant facilities provided for the distillation of crude consist of the original 10 by 40 foot shell still, which for many years operated as a batch unit handling from 300 to 500 barrels daily. This still has been re-manifolded for continuous operation following the installation of a large Southwestern bubble tower. Since the addition of the bubble tower, crude charging capacity has been increased to 1000 barrels per day. Crude charged to the still passes through control sections and inter-changers, and is preheated to the extent that but little firing is required to distill gasoline and kerosene. In addition to these cuts some gas oil is prepared and fuel oil. Yields, however, depend much upon the type of crude being charged.

Crude for the plant is delivered to Phoenix by tank car from the company's holdings in California, notably the new Elwood field. The plant is still processing some Rattle Snake Dome crude produced near Gallup, New Mexico. This oil is interesting in its composition. The color is that of a mixture of gasoline and a small percentage of lemon colored lubricating oil—giving the crude a transparent pale lemon color. Upon distillation this crude yields around 75 per cent. gasoline. The gravity of the crude averages 65 to 75 degrees A. P. I. The refinery usually operates on about equal proportions of the New Mexico and California crude, charging to the plant around 20,000 barrels of oil monthly.

In addition to the installation of the new bubble tower and conjunctive control and regulatory devices, some new pumps, new tankage, etc., the company built a new receiving house, and improved the water circulating system. At this plant city water is employed over the boxes. Water overflowing from the boxes is carried to an underground tank through a long all-metal flume. Usual practice where such flumes are employed to carry water in the open for a long distance has been to construct them of wood. In this instance the company employs some used water pipe of large diameter which was cut in half by the welder and mounted on metal lags. Water flowing from the boxes through this long open flume is appreciably cooled before it overflows into the tank.

Treatment of Refinery Absorption Gasoline by Hypochlorite Method

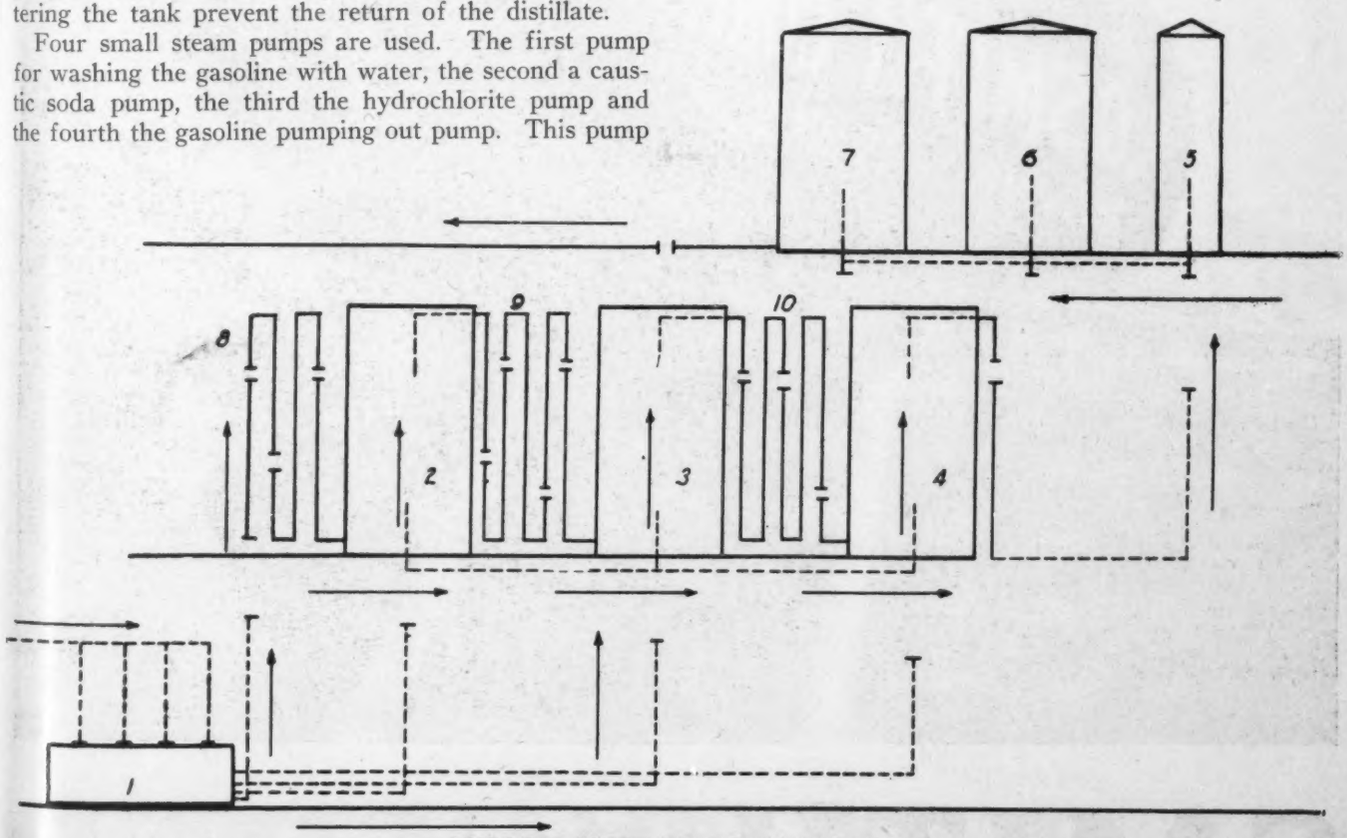
By RALPH E. GOODE

A SUCCESSFUL method employing the sodium hypochlorite treating process as the sweetening agent for refinery tail gases made into absorption gasoline is as follows. The uncondensed gas going into the absorption system at the plant is first given a light caustic wash of eight to 10 Be′ gravity in plant towers. Washing the gas in the towers with the caustic followed with a water wash will aid in preventing corrosion of plant equipment and tend to make later treating easier in the treating system. The caustic and water wash will remove some of the hydrogen sulphide in the gas and probably some of the mercaptans.

The gasoline from the absorption plant's storage tanks may be delivered to the treating system by pressure or by steam pump. The hypochlorite treating plant in general consists of three sets of treating coils and tanks. The coils are of special construction having large outside coils housing an inside coil with perforated and baffled openings. The ends of each of the inside coils coming in are closed producing a thorough mixing of the distillate under pressure of 15 to 20 pounds. Check valves above the coils on the pipe entering the tank prevent the return of the distillate.

Four small steam pumps are used. The first pump for washing the gasoline with water, the second a caustic soda pump, the third the hydrochlorite pump and the fourth the gasoline pumping out pump. This pump may also be used for pumping the gasoline from the absorber to the system should the pressure on the plant tanks not be sufficient to force it into the system.

The gasoline undergoing treating passes from the coils and water wash tank into the second set of coils and tank containing 18 to 20 Be′ caustic soda. The water wash and caustic soda wash remove hydrogen sulphide and free sulphur partially sweetening the gasoline making it easier for the action of the finishing treat of sodium hypochlorite. From the second set of coils and tank containing the caustic soda the gasoline passes under continuous pressure into the sodium hypochlorite treating coils and tank where it is sweetened. The hypochlorite tank is equipped with a relief valve for holding an even pressure on the system. After the gasoline is sweetened in the hypochlorite system it passes into a small storage tank with a water level, the water taking up any soluble salts and foreign matter. The small storage tank also acts as a safety factor in case the gasoline should by chance *go sour* only a shall amount would have to be retreated. From this small



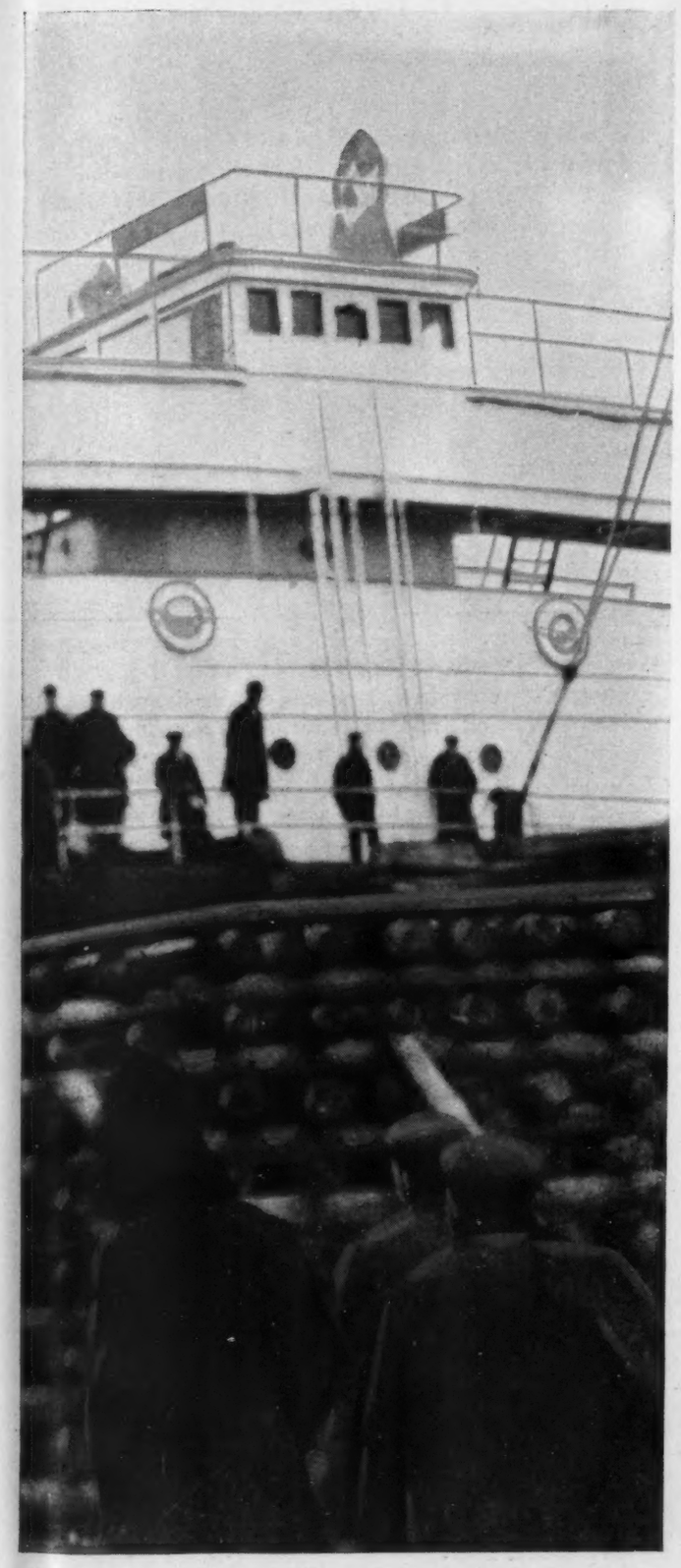
HYPOCHLORITE TREATING PLANT

1. *Pump setting.* 2. *Water wash tank.* 3. *Caustic soda tank.* 4. *Hypochlorite tank.* 5. *Small storage tank.* 6 *and* 7. *Large storage tanks.* 8, 9 *and* 10. *Treating coils.*

ALL OVER THE

SMITH*WELDED*

WORLD



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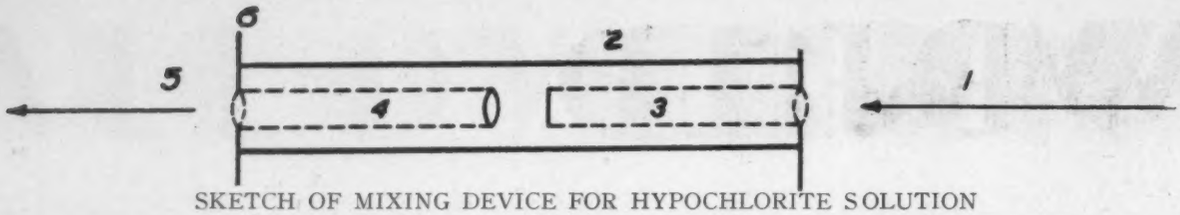


SKETCH OF MIXING DEVICE FOR HYPOCHLORITE SOLUTION

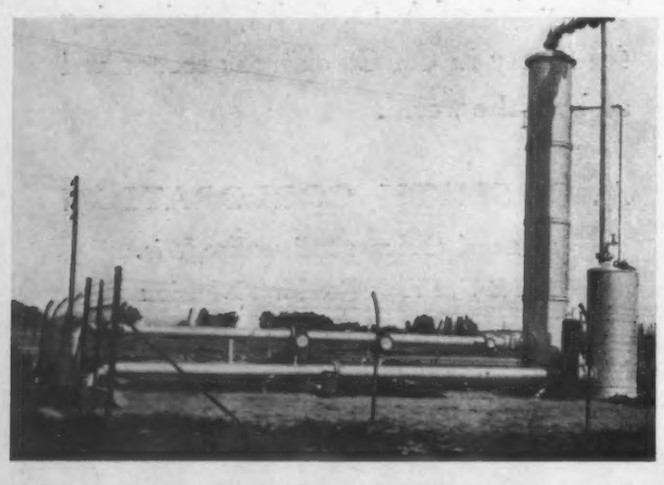
1. *Incoming gasoline.* 2. *Outside coil housing.* 3. *Perforated closed end coil.* 4. *Perforated open end coil.* 5. *Outgoing gasoline.* 6. *Flanged unions*

storage tank the gasoline may be pressured to larger storage tanks.

In making up the sodium hypochlorite solution a 50 to 60 barrel perpendicular tank of small diameter may be used. The chlorine gas is hooked up so as to pass up through the bottom of the tank. The caustic soda is made up to the desired strength and the chlorine gas is admitted very slowly up through the solution by means of a valve. It may also be noted that in making hypochlorite solutions best results are obtained by using comparatively cool caustic solutions. A typical formula for making the sodium hypochlorite solution is as follows: 250 gallons of 18.0° Be′ caustic soda, 2500 gallons of water, one—150 pound drum of chlorine gas.

For testing solutions for available chlorine a standard solution of Silver Nitrate is used. By dissolving 2.396 grams of $AgNO_3$ crystals in one thousand c,c,'s of pure water a solution containing approximately 0.0005 grams of chlorine equivalent each c,c, will be had. This may be standardized against a standard Sodium Chloride solution, the NaCl made as follows: 16.50 grams of fused salt in one thousand c,c,'s of pure water. 100 c,c,'s of this may then be diluted to one liter for obtaining a standard solution each c,c, of which will contain 0.001 gram of Chlorine.

The Potassium Chromate Indicator is made as follows: 50 grams of K_2CrO_4 is dissolved in a small amount of pure water. Silver Nitrate in a very small amount is added which will produce a slight red precipitate. This is then filtered and made up to—1000 c,c,'s in pure water. If the Chlorine content is high in the hypochlorite solution approximately 25 c,c,'s should be used and this diluted to 50 c,c's in pure water. Not over 10 c,c,'s of the Silver Nitrate Solution should be used in reaching an end point. If more is required the hypochlorite solution should be diluted still more. Before starting the titration a few drops of phenolphalein indicator should be used. If a red color appears neutralize with approximately one tenth N. Sulphuric Acid. If the water is acid to methyl orange neutralize with one tenth N. Sodium Carbonate. The detection of the end point may be found easier by comparison with the contents of another dish containing the same quantity of Chromate Solution in the same volume of pure water as the volume of the sample under test.



Unique installation of scrubber and absorption tower operating under automatic control three miles from the main plant site and distillation equipment

Lone Scrubber and Tower

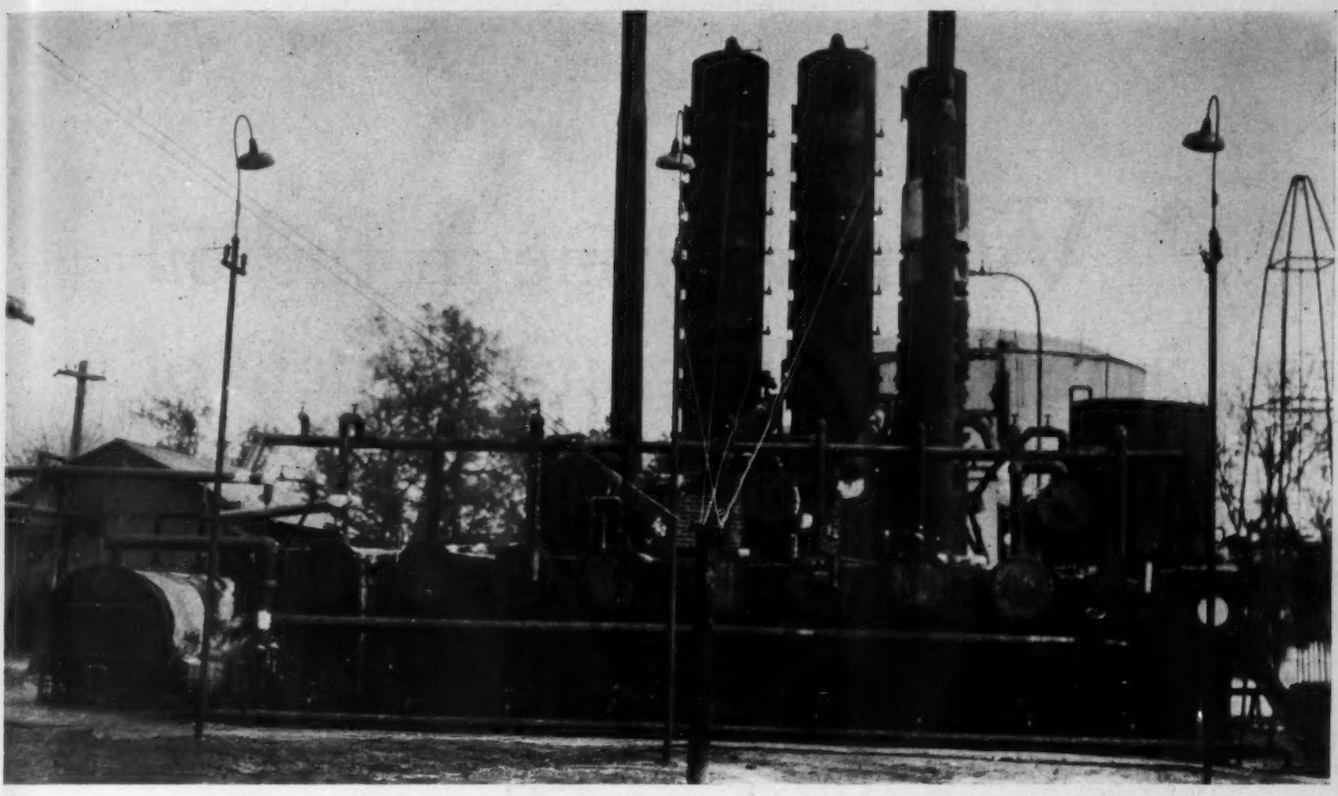
A complete absorption type gasoline extraction plant at the road side along any California highway is no unusual sight. The appearance of a lone scrubber and absorber, together with meters for measuring gas in and out of the apparatus, three miles from the nearest gasoline plant or oil field, however, deserves some comment.

The United States Refining Company, operating an absorption plant at Davidson City, California, with a total capacity of 15,000 gallons daily, is operating its absorption equipment under unusual conditions. Most of the absorbers are located on the plant site but the equipment shown in the accompanying illustration is located three miles from the main equipment for distillation, treating and storage.

The absorber handles gas from a different source, a different pipe line, and at a different location. Cool lean oil is pumped through a two-inch line to the absorber to return through a second line to the heat exchange, preheating and distillation equipment at the plant proper. Control and regulatory devices are installed so that the remote installation requires no attention except for the daily changing of charts on the recording meters measuring gas in and out of the absorber. Controls are worked out and installed so that at any time pressure should build up above a certain limit, or pressure is reduced below a certain limit, the oil pumping equipment is automatically shut down until adjustments are made by the operators. The control devices were placed in service when the unit was installed and were tested. After a year or more the unique installation is still giving uninterrupted service and results are said to be just as satisfactory as if the unit was located on the plant yard proper.

This absorber no doubts occupies the unique position of being the only one in the industry which is operating three miles from its distillation equipment.

A heavy barbed wire fence serves to keep the curious passer-by from tinkering with the equipment.



Producers Oil Company skimming plant at Bristow, Oklahoma, with unique distillation equipment

Small Plant Has Its Economies

THE skimming plant of the Producers Oil Company at Bristow, Oklahoma, although small in capacity is of interest in that cretain features of its operation incorporate commendable practices of economy. It is typical of what is being accomplished at many small plants throughout the country and indicates what oil companies having small crude production may realize from local refineries.

Distillation equipment at the Producers Oil Company's plant consists of a series of small stills made of 20-inch casing. These stills operate in continuous system, there being nine of them in the system, which is divided into three units consisting of three stills each. The third, sixth, and ninth stills are termed master stills for the reason that crude flowing through the two preceding shells is merely heated in transit to the master stills, from where it ascends to a drum placed above the still, where the vaporized portion is liberated into the vapor lines. Crude leaving the master stills is pumped into the next three stills comprising the next distillation unit. Thus, from the nine stills or the three units in the system, three vapor streams are conducted to the bubble towers for fractionation.

With such small heating chambers handling 600 barrels of crude daily, the distillation system and pumping equipment must be constrolled with precision. Through the installation of three liquid level indicators, fabricated and installed on the ground, the level in the master stills is known to the stillman in charge at all times. These indicators consist of a float inside of the still which is raised and lowered by the level of oil in the shell, and actuates a small lever placed outside of the shell. The details of the mechanical construction is shown in an accompanying photograph. C. H. Fox, who has been in charge of plant operations for the past two years, perfected the device some years ago and installed them on these stills in order that the stillmen might control the battery with greater ease. The device has the advantage of being inexpensive as well as positive in its indication. The complete plant consists of two units of nine stills.

Crude entering the system through the exchanger

With everyone in the oil industry talking curtailment of production and conservation of resources, it is a self-delusion to degrade good gas oil into more than fifty percent of fuel oil to be added to the already large surplus

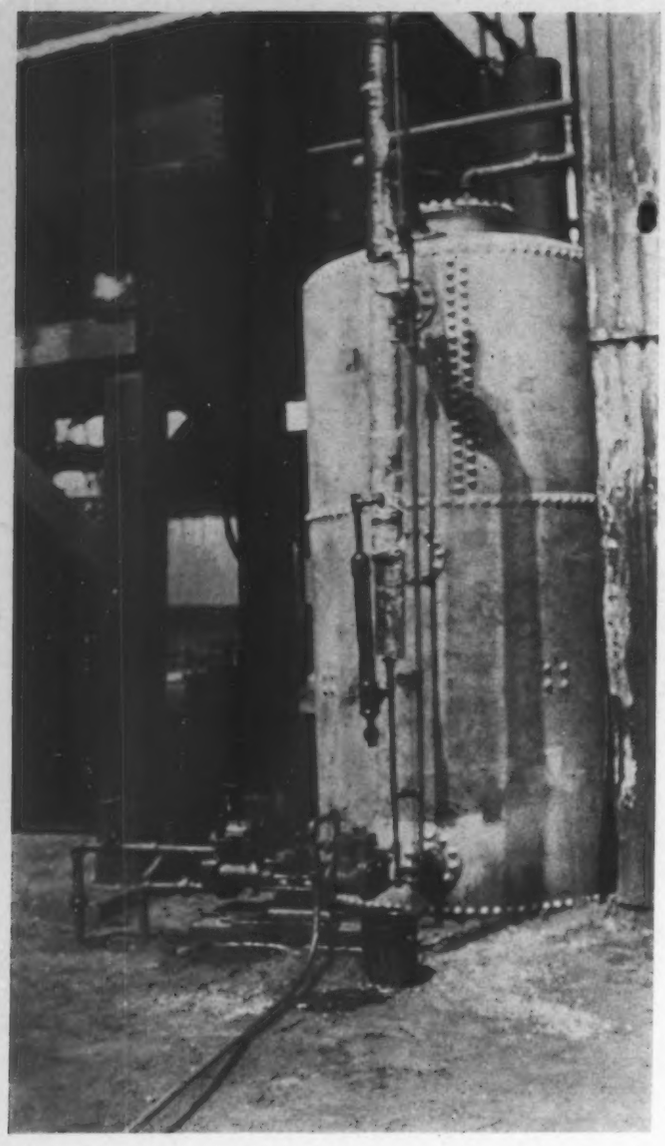
But that is what some refiners are doing in order to obtain less than fifty percent of gasoline from the gas oil

The Dubbs non-residuum

method of operation will produce the maximum in gasoline from either gas oil or fuel oil and no fuel oil will be left to be added to the surplus

Universal Oil Products Co
Chicago, Illinois

Dubbs Cracking Process
Owner and Licensor



Details of hook-up for accumulating recycle stock for spraying over one bubble tower as described

is preheated to about 275 F. getting this heat from residuum leaving the last still at about 525 F.—which in volume is about 60 per cent of the crude charged. Forty per cent of the crude is vaporized and fractionated into gasoline and gas oil. Hempel analysis of the crude indicates a gasoline cotent of 29 per cent. Gasoline recovery from the plant operation is slightly better than this percentage.

Three streams of light products are taken overhead from the bubble towers, two of which reflux back into the distillation system, and the third reflux stream being accumulated as gas oil. The three overhead streams blended together comprise a U. S. Motor gasoline of 437 end point. The initial boiling point of the gas oil averages 435 to 440 F. Fuel oil or residuum is controlled by boiling point, having an initial of 500 F. Zero to 10 F. cold test is secured on the residuum. The gas oil with its high initial is very resistant to emulsification and is sold to a number of gasoline companies for use as absorption oil.

The final boiling point of the third gasoline stream condensed from the vapors derived from the third bubble tower, which handles vapors distilled from the crude at a temperature of 525 F., is controlled by recycling the product of that unit back over the tower. The high temperature on the still is necessary to recover the gas oil fraction. This fraction must be separated in the tower into a naphtha of not over 460 end point and a gas oil bottom stream having an initial of approximately 435 F. Without recycling the product back over the tower its end point would range over 500 F.

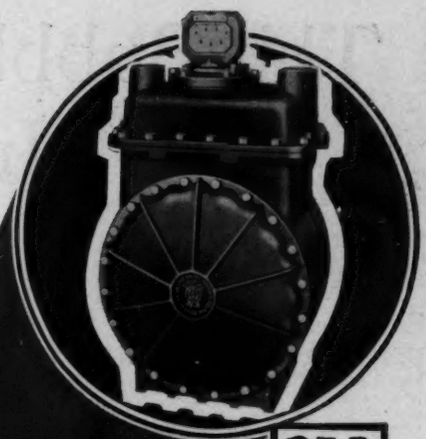
To accomplish the desired results a sealed tank was installed between the condenser box and the receiving house into which the condensate runs through a two-inch line leading well into the tank. The gasoline accumulating in the tank overflows from it into a second two-inch line at the top and into the receiving house. This gives a reservoir from which to draw the recycle stock for spraying over the bubble tower. Details of the hook up are shown in the accompanying illustrations. The small Snow steam pump, size 3 by 2 by 3 inches takes suction on the tank at about its center and discharges this product back into the tower where it is sprayed over the top bubble tray. As it descends it tends to cool and knock back the heavier ends distilled from the crude, and is itself stripped of its lighter fractions by the rising vapors. This practice soon effected a reduction of end point to that point required by the operators. A gauge glass is provided at the bottom of the recycle stock tank to indicate the presence of condensed water derived from the steam used in distillation. This water is drawn off when it accumulates. A second gauge glass at the top of the tank indicates the level of the gasoline present and shows whether or not sufficient quantities are being permitted to pass into the receiving house and to run down tanks. The reflux material accumulating in the bottom of the bubble tower so operated and sprayed over is cooled and taken to storage as gas oil.

GASOLINE WATER WASHED

Two gasoline streams after condensation in the water cooled coils are washed in specially designed water traps placed between the condenser boxes and the receiving house. This is another adaptation of the water washing method applied by many refiners for the purpose of cleaning out a large proportion of hydrogen sulphide gas where it is present, in an effort to combat corrosion and lower chemical treating costs. Some operators washed the gasoline while in the vapor phase and others, such as the Producers Oil Company, wash with fair effectiveness in the liquid stage. This wash-trap, however, was not installed primarily as a corrosion retarding device, since the crude processes comparatively sweet, but was perfected to provide very cool streams of gasoline, as it flows through the look boxes, and thus reduce evaporation losses. Naturally the water wash effects the removal of some impurities, in addition to assisting in the cooling of the stream.

An illustration accompanying this discussion

Two new additions to the... FAMOUS LINE *of* IRONCASE



METRIC METERS

THE two new Ironcase Meters, 25-B and 35-B, each with two pressure ranges, fill in and make a complete line of meters of one type that will meet a comprehensive range of service requirements. They fill the gaps that formerly existed between the 20-B and 30-B, and the 30-B and 60-B Ironcase sizes. Comparison with the nearest older sizes (see table) shows the need for meters with the capacities of the new sizes, and also the advantages represented in their construction.

In construction, they are endowed with longer wearing qualities under the stress of higher pressure measuring jobs.

All Ironcase meters are representatively Metric — in quality of materials and construction, in character, in operation, in reliability and in accuracy. They are made to meet a wide range of service for high, medium and low pressures. The complete line-up includes these sizes: 5-B, 10-B, 20-B, 25-B, 30-B, 35-B, 60-B, 80-B, 250-B and 500-B. All except 10-B are made in two pressure ranges and 60-B and 80-B are made in three pressure ranges.

For the complete Ironcase story, write for bulletins.

Model	Capacity Cu. Ft. per Hour .60 Gravity Gas		Maximum Working Pressure	Net Weight Lbs.
	½" Loss	2" Loss		
20-B	350	600	10	76
20-B	350	600	10-250	180
25-B	400	810	10	95
25-B	400	810	10-100	100
30-B	550	950	15	134
30-B	550	950	15-250	420
35-B	650	1,150	15	135
35-B	650	1,150	15-100	140

Sales Service

Westcott and Greis, Inc.

Dallas Tulsa Los Angeles

METRIC METAL WORKS

of the American Meter Company-Inc.

ERIE - PENNSYLVANIA - U-S-A

This Bubble Tower with Condensers
Installed by the J. P. Devine
Leading

nd Coolers was Designed, Built and Mfg. Company for One of the perators

With its new plant at Mt. Vernon, Ill., being pushed to completion as rapidly as sound construction methods will permit, the J. P. Devine Mfg. Co. is making ready to greatly broaden its already extensive service to the oil industry.

Only the most modern of equipment has been purchased and the plant will be entirely new tooled. Ample ground space has permitted special departments for the handling of oil field equipment and notable additions are being made to the engineering staff.

May we suggest that you make a close survey of present operating costs? Our own staff will be glad to aid in the study. Only a comparison of your figures and those submitted by our own staff which will indicate the results which can be obtained through modernization, can determine whether or not new equipment is required.

J. P. DEVINE MFG. COMPANY, Inc.

MAIN OFFICE, BUFFALO, N. Y.

Plants: BUFFALO, N. Y. AND MT. VERNON, ILL.

New York Office	*Chicago Office*
51 EAST 42ND STREET	122 SOUTH MICHIGAN AVE.

Water trap installation which serves to wash and further cool the gasoline as it comes from the condenser coil, en route to the look box

shows the details of the water washing trap hook-up A three-inch line conveys cool water from a nearby well, to the condenser boxes. At a point just before the water line empties into a box a small line is installed leading to the top of the water trap. Valves on the two lines regulate the amount of water which shall be diverted into the traps. The traps are made of joints of casing about 16 inches in diameter by 20 feet in length. The cool water entering the top of the trap flows downward and exits through a second two-inch line at the bottom which is a swing line, extending upwards on the outside of the trap, and overflowing into a drain line inside of the receiving house—as shown in the accompanying photograph. The height of the swing controls the level of water in the trap.

ECONOMICAL OPERATION

Condensed gasoline leaving the condenser box at the bottom of the coil is conducted downward to a distance within a few feet of the ground level, where the line enters the trap. The gasoline then rises in counter-current contact flow with the cool water, and overflows out of the trap into the rundown line leading into the receiving house. This exposure is about four feet of the trap. The results are that the gasoline stream is cooled to below atmospheric temperature, for the water well on the plant yard yields water at about 52 F., and the washing action tends to remove the small percentage of hydrogen sulphide present in the gasoline. Gasoline leaving the trap is water free. The device is applicable wherever additional condenser or cooling surface is needed on small installations, at little cost, and proves especially beneficial during the hotter months.

The plan operates economically. One Titusville return tubular boiler operating at 85 pounds steam pressure furnishes ample steam for the operation of the refinery and small pumps. All of the transfer and charging pumps are Gardner, 4½ by 5 by 4 inches. Gravity flow of crude to the first charging pump is of benefit. The remaining charging pumps each handle proportionally lesser amounts of crude to stills. Gas is utilized for fuel purposes, and is obtainable at a very reasonable rate, and this cuts down steam consumption. Water for cooling and other purposes is secured at a depth of 60 feet from a 90 foot strata of white water sand—and the supply is so plentiful that it is allowed to overflow into a nearby stream after use for cooling. A second well is not commonly used, but stands by as an auxiliary. Since the installation is small and compact and easily controlled and regulated, very few men are needed for its operation. With low labor overhead, low fuel cost, and through the running of company owned crude production, and with an appreciable amount of its gasoline sold through a company owned service station on the plant yard at the side of a main highway, at retail prices, the small refinery is profitably operated. The Producers Oil Company is affiliated with the Interocean Refining Company and the Western Oil Corporation.

Wichita, Kans.—Phillips Petroleum Company, Bartlesville, Oklahoma, has purchased an 82-acre refinery site here. No definite date has been named on which construction of this plant will start. Phillips Petroleum Company has crude production now in one or two Kansas fields near here and in view of its growing marketing business as well as its crude oil production, a refinery at this point will be strategically located. The company has recently completed installation of a 1000 barrel cracking unit at its Borger, Texas, plant, designed by M. P. Youker, plant manager.

Craig, Colo.—In order to double the capacity of its refinery at this place, The Texas Company has shut the plant down and construction work is being hurried as rapidly as possible in order that work may be resumed about July 1. Craig-made Texaco gasoline will be supplied from storage tanks of the company at this town to service stations in the vicinity.

COMPRESSED AIR QUICKLY FINDS THE WEAKNESS IN ORDINARY PACKINGS.

Avoid Frequent Repacking

by using a packing that will withstand the high temperatures of

COMPRESSED AIR and High Pressure STEAM Superheat.

Such a packing should be made entirely of heat resisting materials, and so perfectly lubricated that it will not harden and create friction.

TRADE MARK

"PALMETTO" PACKING

REG. U.S. PAT. OFFICE

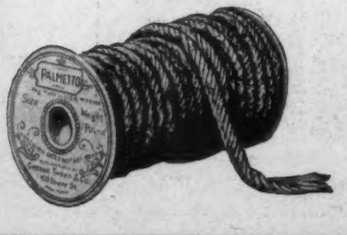
is made especially to resist the extreme temperatures that destroy ordinary packings, having a grade of long fibre high tensile strength asbestos that does not require the addition of cotton, and is the recognized packing to use under Compressed Air and Superheated Steam, where the long service of true economy is desired.

Let us send you a free working sample to test under your own conditions — State size desired.

GREENE, TWEED & CO.

Sole Manufacturers

109 Duane St. NEW YORK



Huntington Beach Plant Has High Yield

OBTAINING a yield of 6½ gallons of gasoline per thousand cubic feet of gas treated, the No. 1 plant of O. C. Field Gasoline Company at Huntington Beach stands out as one of the most efficient layouts in California.

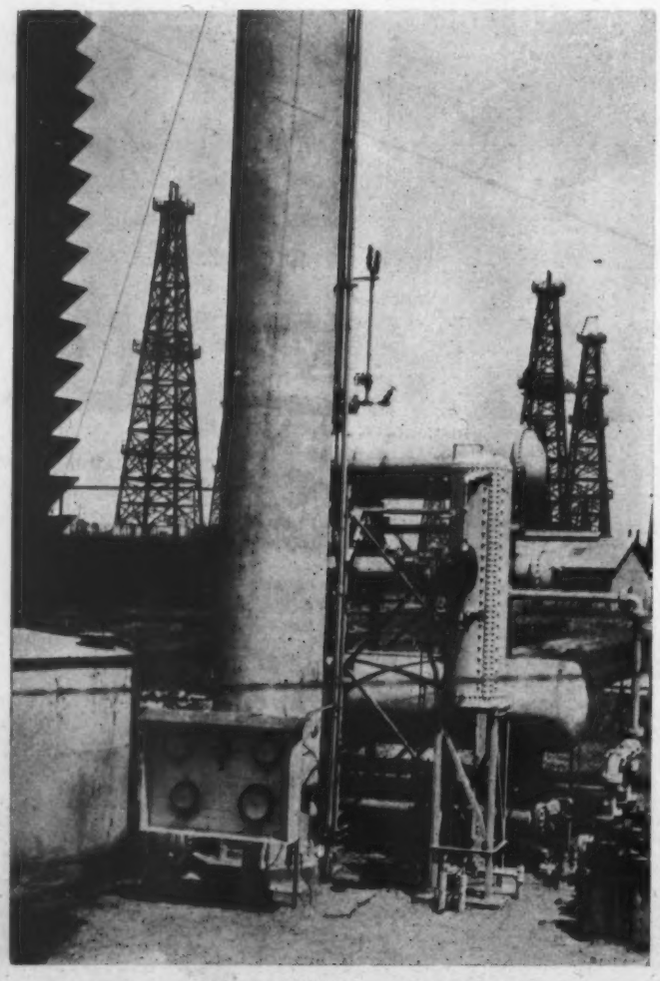
The average yield of gasoline per thousand cubic feet of gas treated in the entire field, including that treeted at O. C. Field Gasoline plants, has been about 2.34 gallons. Of the total amount treated, much of the gas has been circulated and is, therefore, leaner than if it had originally come from the wells.

Located in the Garfield addition, where wells are producing a richer gas than in most parts of the field, the plant is treating a much better product than some of the other plants. It is only fair to mention that the unusual yield could not be obtained from lean gas, and that it would not be impossible for other operators to obtain as high a yield; but, as will be shown in the following paragraphs, it is because of the efficient installations and the wide latitude between the amount of gas actually treated and the maximum capacity of the plant that such high gallonage is recovered.

Capacity of the plant is approximately twice the amount of gas being treated. Each installation is afforded a chance to do its best work under conditions far different from those encountered in plants which are handling from 10 per cent. to 20 per cent. of their efficient maximum capacity.

Gas from the field is picked up at about 14 inches vacuum by four 80-horsepower and one 165-horsepower Clark compressors. These compressors will easily handle much more than the 3½ million cubic feet of gas now being received. They boost the gas to a pressure of 40 pounds and send it to the absorbers.

It is in compressing process that the efficiency of the plant first manifests itself. In stepping up the pressure to 40 pounds, 40 per cent. of the gasoline is removed. This gasoline is taken to the distilling system for clarification and does not enter the remainder of the system. The removal of such a high percentage of the gasoline in what might be termed a preliminary step to the absorption method takes much of the burden from the absorbers and oil circulating system and reduces plant operation expense.



Stabilizer at O. C. Field Gasoline Company Plant

OIL CIRCULATION

From compressors the gas is taken to two 48-inch by 20-foot Boner and Sheldon type absorbers. These absorbers have a capacity of about 10 million cubic feet daily and are operating far below their maximum rating.

Dry gas leaving the absorbers goes to a header for distribution. Tests have shown that the total butane content of this gas is less than .25 gallons per thousand cubic feet. The butane content was determined by Podbielniak's fractionating method, O. C. Field Gasoline Company having been one of the first organizations to use the method in California.

Absorption oil is circulated by two Kinney "Quad" geared pumps, which are circulating about 200 gallons per minute. The pumps are driven by Troy reciprocating engines, the back pressure being held on the exhaust and transferred to the superheaters on the back of the boilers. The steam is superheated from 250° to 485° and then introduced to the stills at about 460°, the small loss coming about in the transfer. This method makes a very dry steam and requires no settler on oil line for dropping out water. These super-heaters take advantage of heat which would otherwise be wasted by radiation and turn it into a profitable energy.

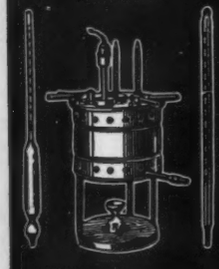
One 6-foot by 18 foot Boner and Sheldon type still is used in the plant. With a capacity of 30,000 gallons, this still has con-

RECORDERS

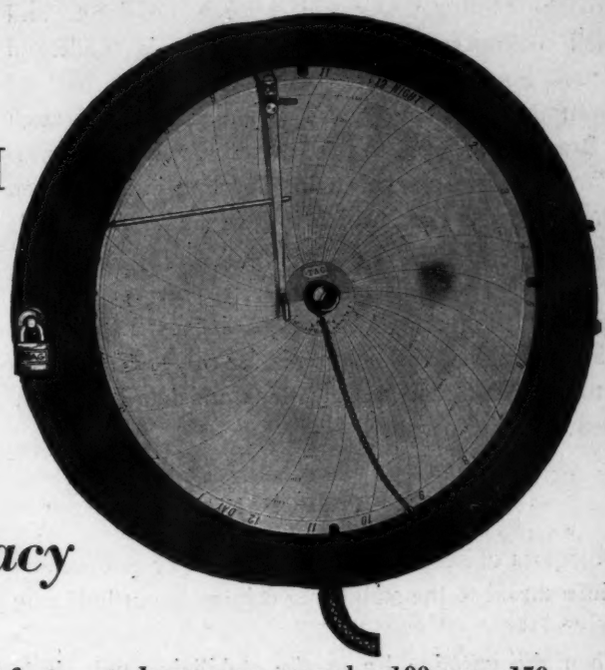
RECORDER - CONTROLLERS

DIAL - INDICATING THERMOMETERS

AUTOMATIC CONTROLLERS


OIL TESTING INSTRUMENTS, THERMOMETERS, HYDROMETERS, ETC

FULLY COMPENSATED TAG ROUND FORM RECORDERS



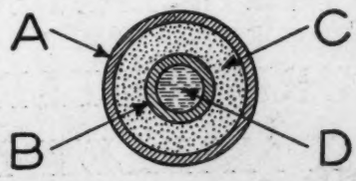
Allowing tube lengths up to 150 feet with Absolute Accuracy

RECORD-MAKING within 25 feet of the bulb center of an installation is often impracticable and long thermo-sensitive connecting tubes introduce inaccuracies with fluctuations of the surrounding atmosphere.

TAG engineers have developed the line of Fully Compensated Mercury Recorders. It is now possible to have your recorder 100, even 150 feet from the installation and yet retain the same TAG accuracy.

Of course, these TAG Recorders are obtainable in the new Round Form — a greatly improved and much handsomer case and at a price that will be a pleasant surprise — equipped for either panel or wall mounting.

The construction of the TAG Fully Compensated Mercury Recording Thermometers (shown in this line drawing) consists of a double connecting tubing, the inner capillary tubing (B) contains the mercury (D) and the space between the inner and outer tubing (A) is filled with gas (C). The gas-filled space acts like a long bulb, connected to a capsular spring in recorder case. This spring shifts fulcrums of mercury mechanism and compensates it for atmospheric temperature fluctuations.



Write for Bulletin No. R 977 — It tells the whole story. . . .
Ask for prices too. . . . they will interest you.

C. J. TAGLIABUE MFG. CO.

18 TO 88 THIRTY-THIRD ST., BROOKLYN, N.Y.

Insist on Mercury Thermometers with the TAG-Hespe RED Reading Column

SINCE 1769

TAGLIABUE Mfg. Co. BROOKLYN

siderable leeway between the amount of gasoline handled and the maximum capacity. The high recovery in the compressing process removes a large share of the burden from the single still.

Vapors from the fractionator are transferred to the top of the cooling tower and through a Griscom and Russell cooling section, while the reflux is condensed and used hot in the fractionating column.

From the fractionator, the vapors are run through five Braun condensers to the separator, where the gasoline and water are separated. Gasoline is then taken to the balancing tank, which is held under 20 pounds pressure.

From the balancing tank, the gasoline goes to an Ereco stabilizing unit, which is 42 inches in diameter and 57 feet high. This column is used to stabilize gasoline to meet contract specifications and has been very successful in its purpose.

FREE OF PROPANE

All vapors off the balancing tanks are re-compressed and introduced to the stabilizing column about half way up.

When the gasoline leaves the stabilizing unit, it is practically propane free. The residue vapors leaving the column are practically butane free.

A representative analysis of the gasoline after it leaves the plant follows:

Methane	.000
Ethane	.000
Propane	.000
Iso-Butane	2.242
Normal Butane	50.104
Pentane Plus	47.654
	100.000

Gasoline from the stabilizer runs to storage tanks more than 500 feet away from the plant. This arrangement reduces fire hazard.

The plant is equipped with a Foamite generating machine, with outlets at all vital points. High pressure steam and water connections are also provided.

While not rated among the largest in California, the plant offsets this handicap with efficiency. About 3½ million cubic feet of gas is being treated, the gasoline gallonage running well above 24,000 gallons. Despite the quality of the gas treated, efficiency is playing a large part in the successful operation of the plant.

SPRAY COOLING EQUIPMENT

FOR PROMPT DELIVERY

EFFICIENT
NON-CLOGGING

OVER 10,000 NOZZLES
DELIVERED FROM STOCK
IN THE LAST 90 DAYS

SECURE BETTER RESULTS
with MARLEY NOZZLES

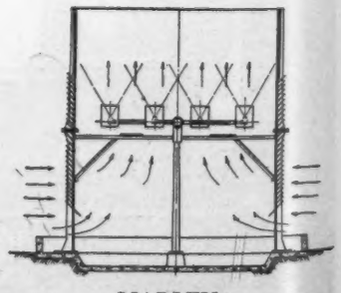
MARLEY
SPRAY POND

The MARLEY COMPANY

1737 WALNUT ST.,
KANSAS CITY, MO.

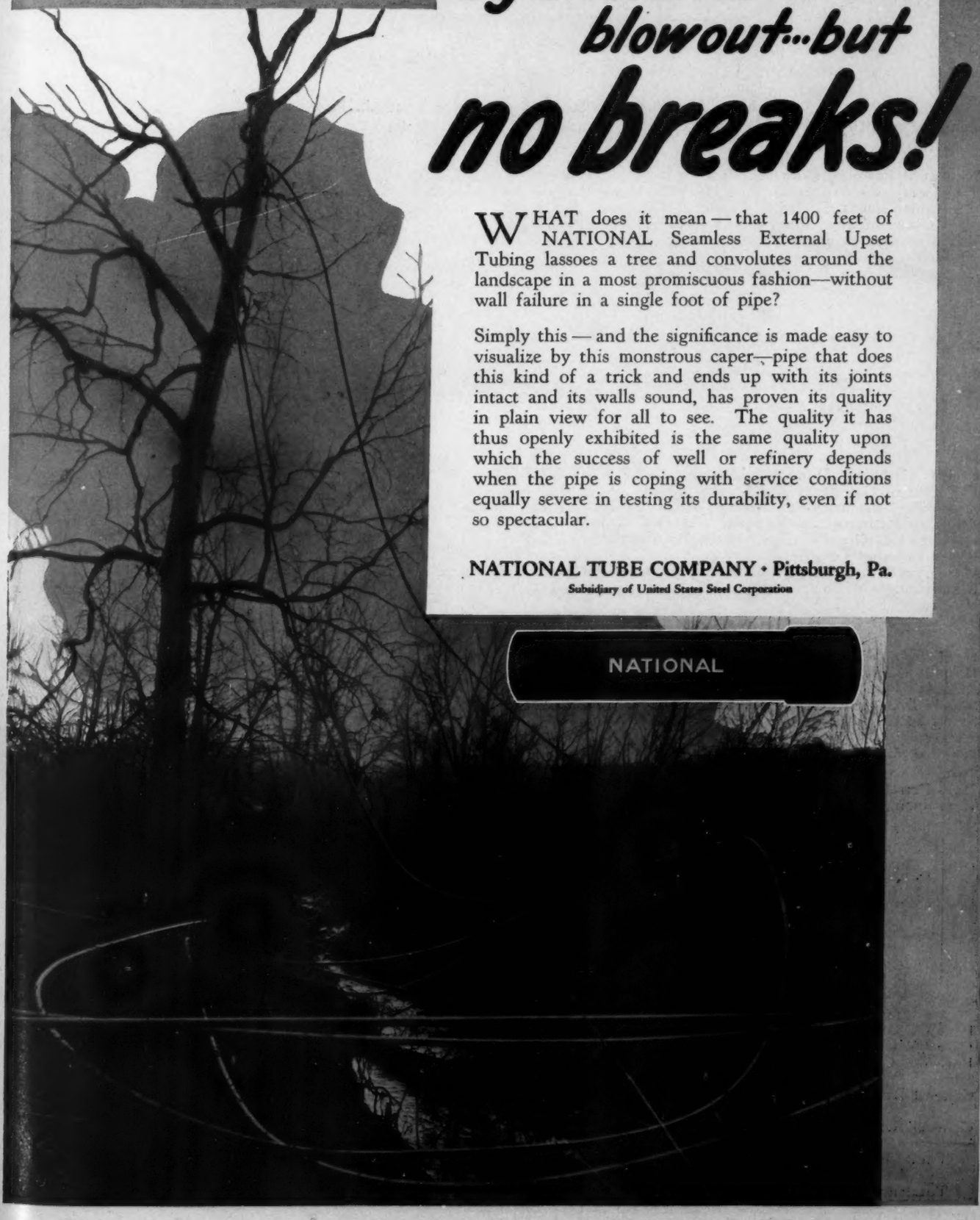
INQUIRIES

SOLICITED



MARLEY
COOLING TOWER

Treed and Bent by a terrific blowout...but no breaks!



WHAT does it mean — that 1400 feet of NATIONAL Seamless External Upset Tubing lassoes a tree and convolutes around the landscape in a most promiscuous fashion—without wall failure in a single foot of pipe?

Simply this — and the significance is made easy to visualize by this monstrous caper—pipe that does this kind of a trick and ends up with its joints intact and its walls sound, has proven its quality in plain view for all to see. The quality it has thus openly exhibited is the same quality upon which the success of well or refinery depends when the pipe is coping with service conditions equally severe in testing its durability, even if not so spectacular.

NATIONAL TUBE COMPANY · Pittsburgh, Pa.

Subsidiary of United States Steel Corporation

ANTI-KNOCK MOTOR FUEL DEMAND RESPONSIBLE FOR LARGE GROWTH OF CRACKING

(*Continued from page* 64)

chambers are 10 by 40 feet in dimensions, weighing 115 tons, and made of seamless steel manufactured in Germany and sent to this country in six rings where they were welded together, using the fluid fusion electric welding process.

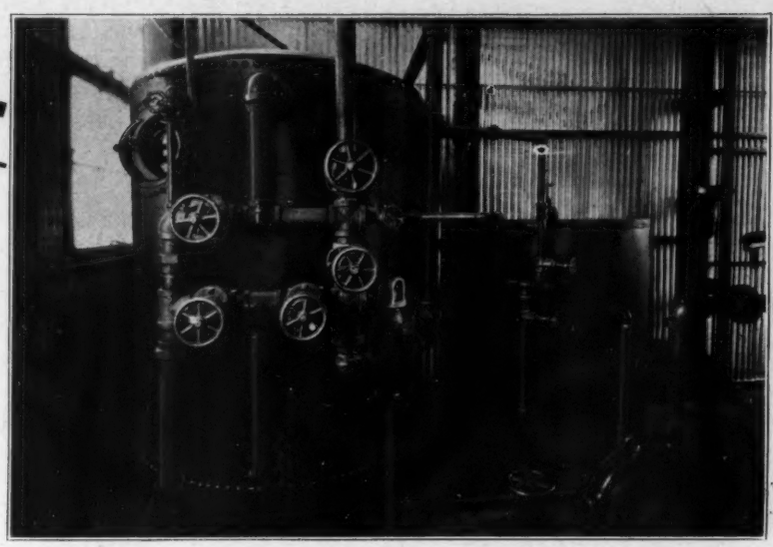
Sun Oil Company has increased its installation of its own cracking process by the addition of two units of 4,000 barrels capacity each. Pure Oil Company at Heath, Ohio, Muskogee, Oklahoma, and Marcus Hoook, Pa., has added five units of the Gyro Vapor Phase cracking unit with aggregate capacity of 4,500 barrels. This Company's Smiths Bluff and Cabin Creek Refineries were provided with Gyro units last year. General Benzol Corporation reports the installation of two processes of different type, namely, four

TABLE 2

Installations Placed in Operation Last Six Months

Company and Type of Process	Location	Units	Unit Size Barrels	Total Capacity Barrels
CROSS PROCESS				
Prudential Refining Corp.,	Baltimore, Md.	2	2,000	4,000
Itaca Compania Argentina Para Le Elaboracion de Productos Petroliferos, Sociedad Anonima,	Campana, Argentina	1	1,000	1,000
Dixie Oil Company,	Superior, La.	1	2,000	2,000
Argentine Government,	South America Oil Fields, Buenos Aires, Argentina	1	2,600	2,600
Cia Ferrocarrilera de Petroleo,	Patagonia, S. A.	1	1,000	1,000
		6		10,600
DUBBS PROCESS				
Wilcox Oil & Gas Company,	Bristow, Oklahoma	1	1,000	1,000
		1		1,000
HOLMES-MANLEY PROCESS				
The Texas Company,	Cody, Wyoming	1	2,000	2,000
		1		2,000
JENKINS PROCESS				
Beckett Company,	Duncan, Oklahoma	1	2,000	2,000
The Cosden Company,	Big Spring, Texas	4	2,500	10,000
Motor Fuel Products Co.,	Laredo, Texas	1	2,000	2,000
Tri-State Refining Co.,	Kenova, West Va.	1	2,000	2,000
Hercules Gasoline Co.,	Los Angeles, California	1	2,000	2,000
Pecos Refining Co.,	Pecos, Texas	2	2,500	5,000
Western Oil & Refining Co.,	Wilmington, California	1	2,000	2,000
Rio Grande Oil Co.,	Vinvale, California	2	2,000	4,000
		13		29,000
TUBE AND TANK PROCESS				
Humble Oil & Refg. Company,	Ingleside, Texas	2	7,500	15,000
Humble Oil & Refg. Company,	McCamey, Texas	2	7,500	15,000
Latonia Refg. Corp.,	Latonia, Ky.	1	1,200	1,200
Standard Oil Co.,	New Jersey, Bayonne, N. J.	6	3,000	18,000
Standard Oil Co.,	Ohio, Cleveland, Ohio	2	1,600	3,200
		13		52,400
TRUMBLE PROCESS				
Italo Petroleum Corp. of Amer.,	Hynes, California	1	500	500
Hutchinson Oil Refg. Co.,	Hutchinson, Kansas	1	500	500
		2		1,000
CARBORUNDUM PROCESS				
Union Oil Co. of Cal.,	Wilmington, California	1	3,000	3,000
LEINTZ PROCESS				
Union Oil Co. of Cal.,	Wilmington, California	1	2,500	2,500
LINK PROCESS				
Standard Oil Company of La.,	Baton Rouge, La.	4	3,750	15,000
DOHERTY PROCESS				
Cities Service Refg. Co.,	East Braintree, Mass.	2	2,250	4,500
SUN PROCESS				
Sun Oil Company,	Marcus Hook, Penn.	2	4,000	8,000
GYRO VAPOR PHASE PROCESS				
Pure Oil Company,	Heath, Ohio	1	500	500
Pure Oil Company,	Muskogee, Oklahoma	1	1,000	1,000
Pure Oil Company,	Marcus Hook, Penn.	3	1,000	3,000
BEGGS PROCESS				
General Benzol Corp.,	Warren, Pa.	4	250	1,000
ARMONT PROCESS				
General Benzol Corp.,	Warren, Pa.	4	250	1,000
Total—last 8 processes		23		39,500
Total units and capacity place in operation last six months..		59 units		135,500 bbls.

Your cooling water — may be the most troublesome and expensive part of your plant

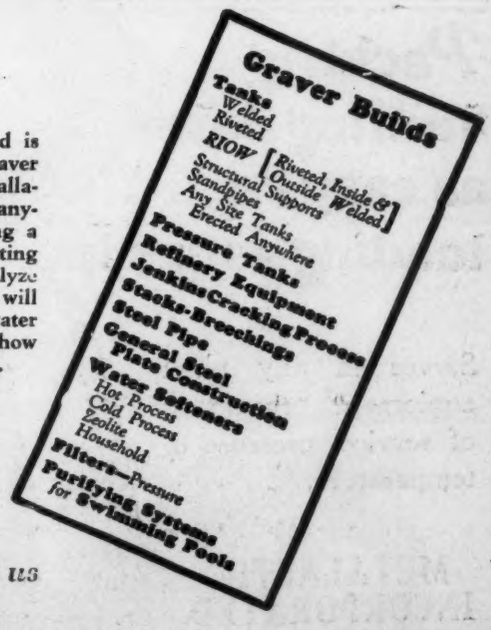


Natural Gasoline Plants

You don't have the opportunity to choose your water supply at a gasoline plant. You take it "as is." And generally "as is" means "hard water" — "muddy water" — "limited water."

If this is the case, and it generally is, you can rest assured that a water softener will be the best paying investment you ever made. You know what hard water will do to your cooling coils by depositing scale, making adequate cooling a problem. In your oil engines it's the same trouble, coating the cylinder with scale and preventing adequate cooling. In the boilers, scale coats the tubes and walls, preventing the ready absorption of heat.

All this trouble can be eliminated and is being eliminated continually by Graver Water Softeners. There are many installations within easy reach for inspection—anywhere in the oil country. In planning a new plant or in any of your operating plants let us get a sample of water, analyze it and recommend the treatment which will give you absolute freedom from hard water taxes. It won't obligate you and will show you what water softening can save you.



Graver Corporation builds all types of water treating equipment. Because of this we are able to make an unbiased survey and recommendation of the type or combination of types of treatment for each water treating problem.

Our Technical Division is at your service. Write us. Give us your problems.

GRAVER Corporation

Founded 1857

EAST CHICAGO, INDIANA

NEW YORK	CHICAGO	FORT WORTH	LOS ANGELES
Grand Cent. Term.	America Fore Bldg.	Petroleum Bldg.	Pacific Nat'l Bank Bldg.

units of Beggs process and four units of Armont process.

CONSTRUCTION OF NEW CRACKING UNITS

Construction of new cracking equipment consists of 99 units under way with a total capacity of 195,800 barrels. Of this number 46 units are being erected in the United States with a total capacity of 100,800 barrels. The remaining 53 units are in course of erection in foreign countries and have a total capacity of 95,000 barrels.

Domestic construction of cracking units breaks down as follows:

State	Refineries Enlarging Capacity			New Plants Adding Cracking Equipment		
	Enlarging Capacity	Units	Capacity	Adding "Crackers"	Units	Capacity
Oklahoma	1	1	2,500	2	3	7,500
Texas	3	13	36,000	8	15	32,300
Michigan	.	.	....	1	2	3,000
Indiana	2	4	8,000	.	.	....
Louisiana	1	4	4,000	.	.	....
Missouri	.	.	....	1	1	2,000
Illinois	1	2	4,000	.	.	....
California	.	.	....	1	1	1,500
Totals	8	24	54,500	13	22	46,300

With 196 refineries in this country provided with cracking equipment, as of June, and with 13 refineries in five states adding cracking equipment for the first time, the completion of present work will increase refineries cracking to a total of 209 plants. At this time there are eight refineries in five states adding a total of 24 units aggregating 54,500 barrels capacity for enlargement purposes. The 13 new refineries entering the "cracking" lists are erecting 22 units with an aggregate capacity of 46,300 barrels.

Packing Stuffing Boxes as easy as loading your pipe
Serves in any plant equipment, regardless of service, pressure or temperature.
METALASTIC INCORPORATED
Jersey City, N. J.
METALASTIC
For All Stuffing Box Requirements!

CONSTRUCTION DETAILS

Of the total of 22 Cross Units under construction at this time, 13 are being erected in this country, the largest single installation being underway at Magnolia Petroleum Company's Beaumont, Texas, plant. Four of the large 3,000-barrel units are adding 12,000 barrels capacity to this plant. Standard Oil of Indiana is erecting two Cross units of the same capacity. The Texas Company is installing seven Cross units at present. At Fillmore, California, The Texas Company will soon complete an 1,800-barrel unit. At its plants at Amarillo, Lockport, Illinois, and Dallas, The Texas Company is constructing a total of six-non-residuum Cross units.

Sixteen Dubbs units are going in in various parts of this country. Shell Petroleum Corporation at East Chicago, Houston, and New Orleans has 12 Dubbs units under way with a total capacity of 18,000 barrels. In two plants the work is that of enlargement. while at Houston the six units are going in with the new Shell Plant on the Ship Channel.

Dubbs, at present, is doing more foreign construction work than is any other process, having a total of 35 units under construction in foreign fields. Details of individual installation capacity is not available at this time and for this reason the total of 35 units under construction was estimated at an average of 1,500 barrels per unit, giving Dubbs a total foreign capacity under construction of 52,500 barrels. Checking this against The Bureau of Foreign and Domestic Commerce report, "Petroleum Refineries in Foreign Countries," 1929, Trade Information Bulletin Number 623, the average taken and estimated total capacity is seemingly adequately accurate. The sources mentioned report Dubbs units under construction as of January 1, at 28 units, with total capacity of 46,700 barrels, or an average capacity per unit of 1596 barrels. The majority of work under way both January 1 and June 1, according to available information sources, is underway in the West Indies, Continental Europe, and East Indies. Referring further to the Bulletin Number 623, it is found that on January 1, 1929, the Dubbs, Cross and Jenkins units had a total of 47 units, with aggregate capacity of 83,300 barrels, under construction in foreign countries at the first of this year. Six more foreign units are now underway.

Gulf Refining Company at its Port Arthur plant is enlarging its cracking facilities which heretofore have consisted only of its own Buerger process, by the present construction of six high-pressure Holmes-Manley units with a total capacity of 18,000-barrel units. One Holmes-Manley unit is under construction at Fiume, Italy, and The Texas Company is itself installing three of its own units at San Antonio, Texas (two units) and El Paso, Texas, (one unit).

Of the 16 Jenkins units now in course of erection eight are in this country where five are going in at Texas refineries and three in Oklahoma. Domestic

. . . Piping *that need never leak*

PIPING welded by experienced operators properly supervised is piping *that need never leak.*

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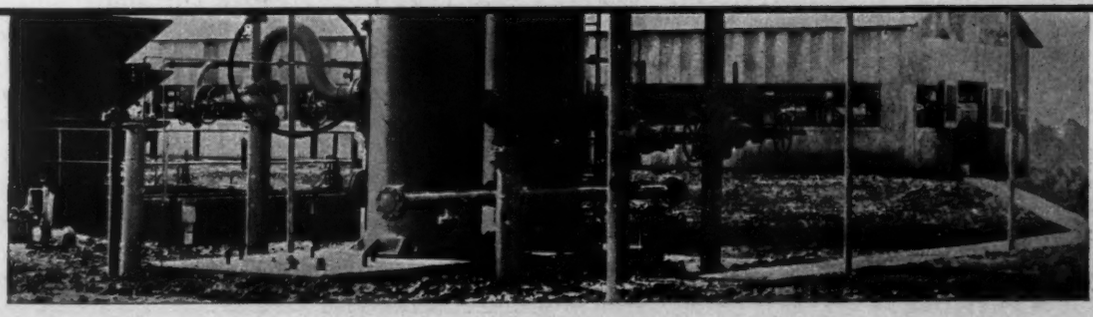

construction totals 20,000 barrels capacity. Of the remaining eight foreign units, six are under construction for the Russian Oil Commission, one for McColl Frontenac Oil Company, Ltd., Montreal, Canada, and one for Raffinerie Nationales de Petroles, Bruxelles, Belgium.

Taking the two tables—"Installations Placed In Operation During Last Six Months," Table 2, and "Installations Now Under Construction," Table 1, and adding the totals, it is found that the status of the cracking phase of the refining industry is expanded by a total of 158 cracking units, having a total capacity of 331,300 barrels, which must be added to former surveys. This indicates an expansion during the past six months and now in progress of 22.2 per cent.

Large Construction Program Justified by Annual Growth in Demand for Refined Oils

CONCERTED effort on the part of the refining industry to provide facilities for the manufacture of gasoline to meet an indicated and actual increase in demand for this major product has resulted in a condition of growth and expansion within this branch of the petroleum industry which has not been paralleled since 1920.

While the number of completed refineries has been decreasing for the past four or five years, during which period the drop was from 547 to 413, present surveys indicate an increase in the number of plants to 430 at the completion of current building programs. During this same period, however, refining capacity in the United States has been steadily increasing, with still further increases in capacity indicated.

This branch of the petroleum industry, even though it is expanding its crude oil capacity rapidly, may be said to be apparently in a healthy condition, as is indicated by the resumption of operations by many shut down refineries, and a marked decrease in the number of installations dismantled. The number of plants under construction has increased from 14 on January 1 to 20 on June 1, and the total rated operating capacity of the industry has been increased during the past six months. This is entirely in line with estimated increased demand for gasoline and oils this year, and next year, with projected demand curves indicating a necessity for still further expansion of the refining industry in the future.

An analysis of the present situation and trend indicates that refiners in the majority of instances are carrying out a steady program of expansion which is justified by the increase in demand for petroleum products. While the end of the present 12-month period will find the industry with an apparent over capacity of approximately 20 to 30 per cent. more than actual crude runs, it is well to bear in mind that capacity ratings are influenced by two factors, namely, the owners pride in the plant, and the fact that only about 80 per cent. of the average refinery capacity or equipment is in service at any one time, due to necessary shut-downs for cleaning and repairs. The rated capacity of the refining industry has always been recorded between 20 and 30 per cent. higher than average crude runs to stills. However, the present expansion program in this industry, as the work is completed during the next year, will bring about a gradual increasing crude processing capacity from the present figure of 3,325,890 barrels (operating capacity January 1, 1929, Bureau of Mines) to 3,508,290 barrels. This estimate is exclusive of new projects announced after June 1.

CONDITION OF INDUSTRY JANUARY 1, 1929

For the purpose of analysis and in order to indicate the concentration of expansion throughout the eight refining districts of the United States and to forecast something of refining ability of these districts and the industry as whole for the coming months, it is necessary to first break down and detail the status of the industry as of January 1, 1929. According to Bureau of Mines Information Circular Number 6116, "Petroleum Refineries in the United States, January 1, 1929," by G. R. Hopkins and E. W. Cochrane, there were 14 refineries building January 1 with a total capacity of 99,000 barrels daily. This figure is equal to 2.97 per cent. of the total operating capacity of refineries in this country.

The majority of this contruction work was concentrated in Texas as a consequence of the rapid development of the producing areas in West Texas. At that

NINE refineries have been completed and placed in operation this year, adding 1.9 per cent. to the total operating capacity of the refining industry. Twenty refineries are building or proposed in the United States. They will add three per cent. to the total operating capacity as reported January 1. Most of the building projects are located in Texas, the Indiana, Illinois, Kentucky and Michigan refining districts and the Oklahoma, Kansas district. Some expansion work is under way in each of the other five districts.

Completion of the present work will increase the rated operating capacity of the industry from 3,325,890 barrels to 3,508,290 barrels daily.

Charging crude at the same rate as last year (79 per cent. of its average operating capacity) the refining industry will charge crude to stills at the rate of 2,771,549 barrels daily when present expansion is completed. This is at the rate of 1,011,625,385 barrels per year.

At 40 per cent. gasoline recovery the industry can then produce 404,650,154 barrels of gasoline annually. Since the estimated demand for gasoline in 1929 is 393,000,000 barrels, a possible production of 404,000,000 barrels the following year does not seem out of line. The present expansion program of the refining industry is therefore justified.

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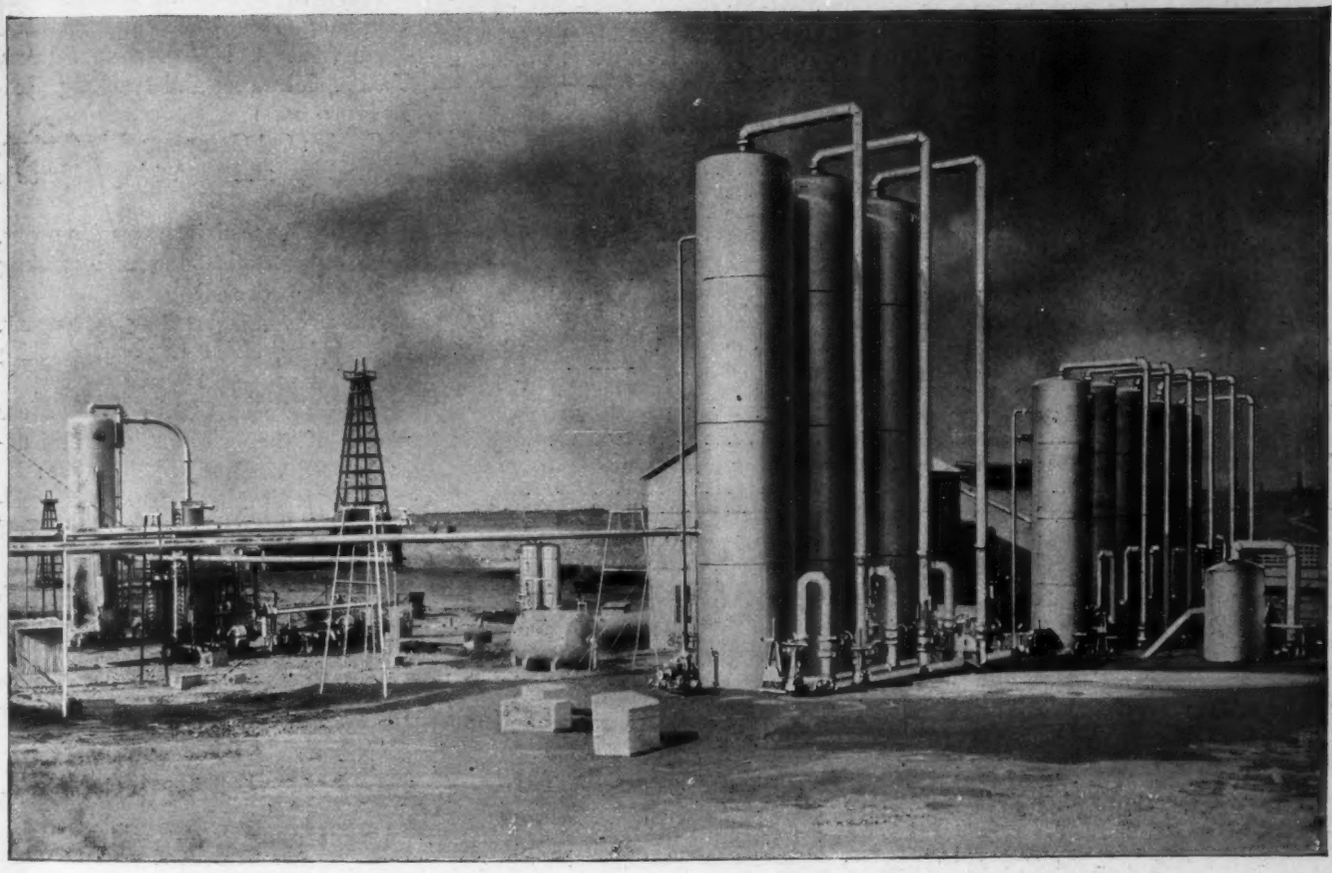

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TABLE NUMBER 1

Status of Refineries Building as of January 1, 1929, and Status of same plants June 1, 1929. (Bureau of Mines—Circular 6116 Petroleum Refineries in the United States)

Districts	Plants Building	Name of Company and Location	Capacity Rating	June 1st. Status
East Coast	.	.....	...	.....
Applachian	.	.....	...	.....
Ind., Ill., Ky., Tenn., Michigan, etc.	1	White Star Ref. Co., Trenton, Mich.....	6,000	Building
Okla.-Kans., etc.	1	Seminole Ref. Co., Seminole.....	1,000	Operat.
Texas	1	Amarillo Pro. & Ref. Co., Del Rio.....	2,500	Operat.
	1	Burford Oil Co., Pecos.....	5,000	Operat.
	1	Cosden Oil Co., Big Springs.....	10,000	Operat.
	1	Great West Ref. Co., Big Springs.....	5,000	Operat.
	1	Gulf Ref. Co., Sweetwater	5,000	Building
	1	Richardson Ref. Co., Big Springs.....	5,000	Operat.
	1	Shell Pet. Corp., Houston.....	20,000	Building
	1	The Texas Co., El Paso.....	1,500	Building
	1	The Texas Co., San Antonio.....	3,000	Building
La. and Ark.	1	J. B. Berry's Sons Co., El Dorado.....	2,000	Operat.
Rocky Mountains	1	The Texas Co., Cody Wyo.....	3,000	Operat.
California	1	Gen. Pet. Corp., Torrance.....	30,000	Operat.
Total Number Plants	14	Total Building January 1st.....	99,000	
		Table 1—Total Building June 1st.....	35,500	
		Table 1—Total Operating June 1st....	63,500	
			99,000	
Table 1 and 2—Grand Total—Number Plants Building and Proposed June 1st, 1929			100,000	
Table 1 and 2—Grand Total—Capacity Plants Building and Proposed June 1st, 1929			20	

TABLE NUMBER 2

New Refining Plants Announced, Proposed, Building, and Resumed Operations Since January 1, 1929, as of June 1, 1929.

District	Company Name Location	Capacity	Status	Number Plants
East Coast—Gulf Ref. Co., Staten Island N.Y.		No report	Proposed	1
	Prudential Ref. Co. (Marland) Md....	7,000	resumed operations	1
Appalach.—Penncrude Ref. Co., Kennerdal, Pa.		400	resumed operations	1
Ind., Ill., Ky., Tenn., Michigan., etc.—				
	The Apex Oil Co., Nashville, Tenn...	500	resumed operations	1
	Empire O. & R. Co., Chicago, Ill.....	15,000	building	1
	Globe O. & R. Co., Lemont, Ill.....	5,000	rebuild. & enlarge	1
	Old Dutch Ref. Co., Muskegon, Mich..	3,000	building	1
	Michigan Cent. R. Co., Muskegon, Mich.	3,500	building	1
	Muskegon Refs., Inc., Muskegon, Mich.	500	building	1
*E. C. Check & Associates, Muskegon, Mich.		3,000	*announced & proposed	1*
Okla., Kans., etc.—				
	Illinois Oil Co., Cushing, Okla.....	3,500	resum. & enlarging	1
	Interocean Oil Co., purchased by Producers O. Co., Bristow, Okla.....	2,000	rebuilding	1
	Tex. Pacific O. Co., Wynnew'd. Okla..	3,000	resumed operation	1
Wewoka Ref. Co., Wewoka, Okla.....		1,000	building	1
Walters Ref. Co., Walters, Okla.....		1,500	resumed operation	1
	Wilcox O. & G. Co., Bristow, Okla...	2,500	rebldg., part op.	1
Texas—Central Texas Ref. Co., Luling, Tex.		2,000	announced & proposed	1
	Golden West Ref. Co., Hondo, Tex...	500	resumed operation	1
	Humble O. & R. Co., Boggy Creek...	5,000	building	1
	Tidal Ref. Co., Houston.....	15,000	proposed	1
La. & Ark.—Big Chief O. Co., New Orleans		5,000	announced	1
Rocky Mountain—				
	White Eagle O. & Ref., Casper	3,000	will enlarge	1
California—El Camino Oil Co., Santa Fe Spgs.		1,500	building	1
		83,400	Total	23

Table 2—Announced or proposed—5 ..	25,000
Table 2—Resumed operation—7.....	16,400
Table 2—Building—8	34,500
Rebuilding, Enlarging, part op.—3.....	7,500
Total Capacity	83,400

*Proposed to move West Oil Corporation from Wichita Falls, Texas to Michigan.

time there were nine plants in course of construction in the state. In the accompanying Table Number 1 there is given the status of refineries building in this country as of January 1, and in the right hand column there is shown the status of these projects as of June 1. During this period the following companies completed refineries and placed them in operation in the district:

Amarillo Producing and Refining Company, Del Rio, skimming plant.

Burford Oil Company, Pecos, Texas, skimming and cracking (Jenkins process.)

Cosden Oil Company, Big Springs, skimming and cracking (Jenkins process.)

Great Western Refining Company, Big Spring, skimming and cracking (Rowsey process.)

Richardson Refining Company, Big Spring, skimming and cracking (Jenkins process.)

This completed work left but four plants of the original nine still uncompleted on June 1. They are:

Gulf Refining Company, Sweetwater, skimming and cracking (Gulf process.)

Shell Petroleum Corporation, Houston, skimming and cracking (Dubbs process.)

The Texas Company, El Paso, skimming and cracking (Holmes-Manley.)

The Texas Company, San Antonio, skimming and cracking, (Holmes-Manley process.)

There was no construction under way or announced at the beginning of the year in the East Coast or the Appalachian districts. In the Indiana, Illinois, Michigan district, White Star Refining Company, Trenton, Michigan, was started work on its 6000-barrel plant, skimming and cracking, two Dubbs units. In Oklahoma-Kansas, the Seminole Refining Company was still constructing its 1000-barrel skimming plant, which has since been placed in operation. The Texas Company was building its 3000-barrel Cody, Wyoming, plant in the Rocky Mountain district, employing skimming practice and Holmes-Manley cracking equipment. This plant is now reported operating. In the Louisiana and Arkansas district, J. B. Berry's Sons Company was building its 2000-barrel asphalt plant, since placed in operation. The California district contributed only one plant, that of the General Petroleum Cor-

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TABLE NUMBER 3

Status of Refining Industry in the United States by Districts and Estimated Status Upon Completion of Present Expansion as of June 1, 1929

District	Jan. 1, 1929 Operating plants	Barrels capacity operating	June 1, 1929 Plants building and proposed	Barrels capacity building or proposed	Plants and barrels capacity resume operation since Jan. 1, 1929	Plants and barrels capacity completed and in operation since Jan. 1, 1929	Forecast Operating status on completion present work barrels capacity	Total number plants
East Coast	24	588,200	1	No report	1— 7,000	.....	595,200	26
Appalachian	55	116,200	..	.....	1— 400	.....	116,600	56
Ind., Ill., Ky., Tenn., Mich., etc.	27	324,000	7	36,000	1— 500	.....	360,500	35
Oklahoma and Kansas	59	415,700	2	3,000	4—10,500	1— 1,000	430,200	66
Texas	68	658,100	7	51,000	1— 500	5—27,500	737,600	81
Louisiana and Arkansas	22	251,830	1	5,000	.....	1— 2,000	258,830	24
Rocky Mountain	34	130,400	1	3,000	.....	1— 3,000	136,400	36
California	52	841,460	1	1,500	.....	1—30,000	872,960	54
Totals	341	3,325,890	20	100,000	8—18,900	9—63,500	3,508,290	378

Indicated increase in total plant capacity—182,400 bbls. daily.

poration, but with a 30,000-barrel daily skimming capacity rating. These companies and plants comprised the total of 99,000 barrels new capacity, of which 63,500 barrels has been since placed in the operating capacity list. This amounts to the addition of 1.9 per cent. of the total operating capacity as of January, 1929.

During the first six months of 1929 the concentrated effort in refining expansion has been diverted from Texas to such districts as the Indiana, Illinois, Kentucky and Michigan area and the Oklahoma-Kansas district, and to include some expansion work in all of the eight manufacturing districts. In the United States the situation may be summed up in the statement that of the 14 plants building January 1, nine are now operating, which leaves five still building. In addition and at present, 15 more plants are building or proposed, giving a total of 20 building plants in the program now under way, which for the most part are new installations. The total capacity now under construction is 100,000 barrels daily. January 1 it was 99,000 barrels. Despite the fact that the industry has added 1.9 per cent. of the total operating capacity it is still in process of adding three per cent. more capacity.

In the East Coast district, one major company proposed a plant on Staten Island for which no capacity figures are at present available. The Prudential Refining Company (now Marland), Baltimore, Maryland, has resumed operating its skimming plant, equipped with Cross and Dubbs cracking units. In the Appalachian district the Penncrude Refining Company's skimming and lube type plant has been reported as resuming operation. A 5000-barrel plant has been announced for the Louisiana and Arkansas district by the Big Chief Oil Company, New Orleans. In the Rocky Mountain district, White Eagle Oil & Refining Company, Casper, announces enlargements under way. In California there is only one refinery under construction, that of El Camino Oil Company skimming plant, at Santa Fe Springs. However, the operating capacity of California has already been increased by 30,000 barrels this year by the completion of General Petroleum Corporation's Torrance skimming plant. Details of the present situation showing plants under construction, proposed, announced, and resuming operation, since the first of this year, are shown in Table Number 2.

It will be noticed that concentration of building and expansion appears primarily in the Indiana, Illinois, Michigan district where seven plants with a total capacity of 36,000 barrels are building or proposed. Those building are: Globe Oil & Refining Company at Lemont, Illinois, where the old Lamont Refining Company plant is being reconditioned and enlarged from 1500 to 5000 barrels per day. At Muskegon, Michigan, The Old Dutch Refining Company, the Michigan Central Refining Company, and Muskegon Refineries, Inc., plants are all reported building. E. C. Check and associates propose moving the old plant at Wichita Falls of the Western Oil Corporation to Michigan. All of these plants are directly traceable to the development and exploitation of the Muskegon oil fields. The largest project under way in this territory is that of the Empire Oil & Refining Company at Chicago, with its capacity of 15,000 barrels. It is reported that the plant will have 8000

TABLE NUMBER 4

Tabulated History of Refining Industry in the United States to June 1, 1929. Recapitulation by years to January 1, 1929. (From Bureau of Mines.)

Date	Plants Building Number	Plants Building Capacity bbls.	Plants Completed Number	Plants Completed Cap. bbls.
January 1, 1914*	.	...	176	...
January 1, 1918	.	...	267	1,186,155
January 1, 1919	.	...	289	1,295,115
January 1, 1920	99	263,500	373	1,530,565
January 1, 1921	44	76,600	415	1,888,800
January 1, 1922	30	59,950	479	2,109,200
November 1, 1924	8	18,200	547	2,814,332
January 1, 1925	6	37,000	541	2,827,837
May 1, 1925	4	11,000	550	2,853,842
January 1, 1926	2	5,500	510	2,852,967
January 1, 1927	7	61,000	466	3,061,007
January 1, 1928	5	22,000	423	3,250,380
January 1, 1929	14	99,000	413	3,509,540
June 1, 1929**	20	100,000	430	3,591,940

*From the Bureau of Census.

**From Survey of the REFINER AND NATURAL GASOLINE MANUFACTURER, June, 1929.

NOTE: Capacity added first six months 1929, 82,400 barrels daily, 17 plants.

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barrels cracking capacity, Doherty units, but the report has not been confirmed.

In the Oklahoma-Kansas district, two refineries are building, four have resumed operations, and one new plant has been completed since January 1, adding 14,500 barrels daily to the operating capacity of this area.

Texas, despite the completion of five refineries since January 1, still has seven plants under way, with but one of them in the "proposed" list,—that of the Tidal Oil Company at Houston. The Humble Oil & Refining Company at Boggy Creek, 5000 barrels, skimming, is reported under construction as is the Central Texas Refining Company plant at Luling. Completion of present construction in Texas will add 51,500 barrels to its daily capacity.

In addition to the detailed list of activities as shown in Tables 1 and 2, there are a large number of expansion programs under way in this country which are not enumerated here for the reason that much of the equipment going in will replace present obsolete units and will not tend to increase the operating capacity of the industry to any large extent.

CAPACITY COMPARISONS

It is interesting to note that with an operating capacity of 3,325,890 barrels daily on January 1, the refining industry had but 183,650 barrels of shut down capacity. In other words, five per cent. was shut down and 95 per cent. was operating, which indicates a healthy condition. In numbers of plants, 341 were operating and 72 were shut down on January 1, 1929.

A further interesting item disclosed by a study of the tables presented is that the total indicated increase in refinery capacity which will prevail upon completion of present known work in the industry is 182,400 barrels, and this figure very nearly approximates the total shut down capacity of the industry or 183,650 barrels. This would indicate that the new construction is actually required to offset any decrease in capacity due to abandoned plants which, for the most part, are provided with obsolete or worn-out equipment. It is a fact that a great many of the shut down plants should be omitted from any further surveys of refining industry capacities and plants, since for the most part nothing remains of value except the site.

EXPANSION PROGRAM JUSTIFIED

Demand for crude petroleum for the year 1929 is estimated at 995,000,000 barrels. The situation in regard to crude consumption was adequately discussed by H. J. Struth, Petroleum Economist, Gulf Publishing Company, in *The* OIL WEEKLY, a sister publication to the REFINER AND NATURAL GASOLINE MANUFACTURER, issue of February 22, 1929, page 45. In his "Preliminary Survey of 1929 Crude Demand," Struth pointed to the fact that to meet the requirement of the 1929 gasoline market this year "the quantity of crude required to produce gasoline demand is 995,000,000 barrels," or 2,507,123 barrels per day. It is interesting to note that crude oil production for April, 1929, was at the rate of 2,670,000 barrels daily, according to the Bureau of Mines. These figures give some idea of the refinery crude run requirements this year. Further interesting data regarding gasoline demand for 1929 is presented by Struth in the PETROLEUM MARKETER, issue of May, 1929, page 25, under the title "Eleven Per Cent Gain in Gasoline Demand Forecast." An analysis of gasoline demand and refinery operations was presented by Struth before the A. I. M. E. convention, New York, and was published in *The* REFINER AND NATURAL GASOLINE MANUFACTURER, issue of March, 1929, "Gasoline Economics and Refinery Operation." This analysis of future demand over a period of some six years serves to justify the position of the refining industry in its present program of expansion and the proposed continuation of enlargement which will extend over the next few years.

Last year, 1928, the crude demand was 932,000,000 barrels. The average amount of crude charged to stills by refineries was 2,494,000 barrels per day (Bureau of Mines). Multiplying by 365 we have a total refinery consumption of 910,310,000 barrels for the year. The indicated increase in demand for 1929 was sufficient to justify the present expansion program in the refining industry.

In order to satisfy the estimated demand for gasoline this year, and to handle the 915,000,000 barrels to be furnished by American producers alone, the refining industry must maintain an average of 2,507,123 barrels daily crude to stills. This means that practically 75 per cent. of the present operating capacity of 3,389,390 barrels must be kept in service. This is about the average operating proportion of the rated operating capacity which the industry can keep in service, securing an average recovery for the entire industry of 39.5 per cent. gasoline from the crude treated.

IRREGULAR RUNS

Crude run charts invariably indicate the seasonal influences in the refining industry with high runs part of the year and low crude throughput the rest of the year. This is one of the unsatisfactory conditions which has always been at hand to contend with. However, there is a growing tendency among refining companies to provide much more storage facilities wherein gasoline and other products may be held during the so-called "off season" for marketing when the demand becomes brisk. This is a commendable practice even though somewhat costly, for practically all refiners agree that it is the period of rush activities which throws their equipment out of balance and affects the efficiency of the scientific refining plant, and tends to the destruction of much equipment through over-taxing the plant facilities. It is highly probable that a more moderate operating rate extending throughout the year which would aggregate the same total amount crude distilled per year, enabling the plant to operate at its maximum efficiency, and storing the excess gasoline during winter months, would result in the more profitable manner of operation with less repairs to equipment and less shut-downs for such repairs.

With the present expansion and building program maintained and with the present ratio of shut down capacity to operating capacity maintained throughout the period, the refining industry will have increased its rated operating capacity to 3,508,290 barrels per day when the work is completed. Assuming that the industry can maintain its proportion of crude runs to stills at 79 per cent. of its average rated operating capacity, it will, at that time, be able to charge crude to stills at the rate of 2,771,549 barrels daily. This

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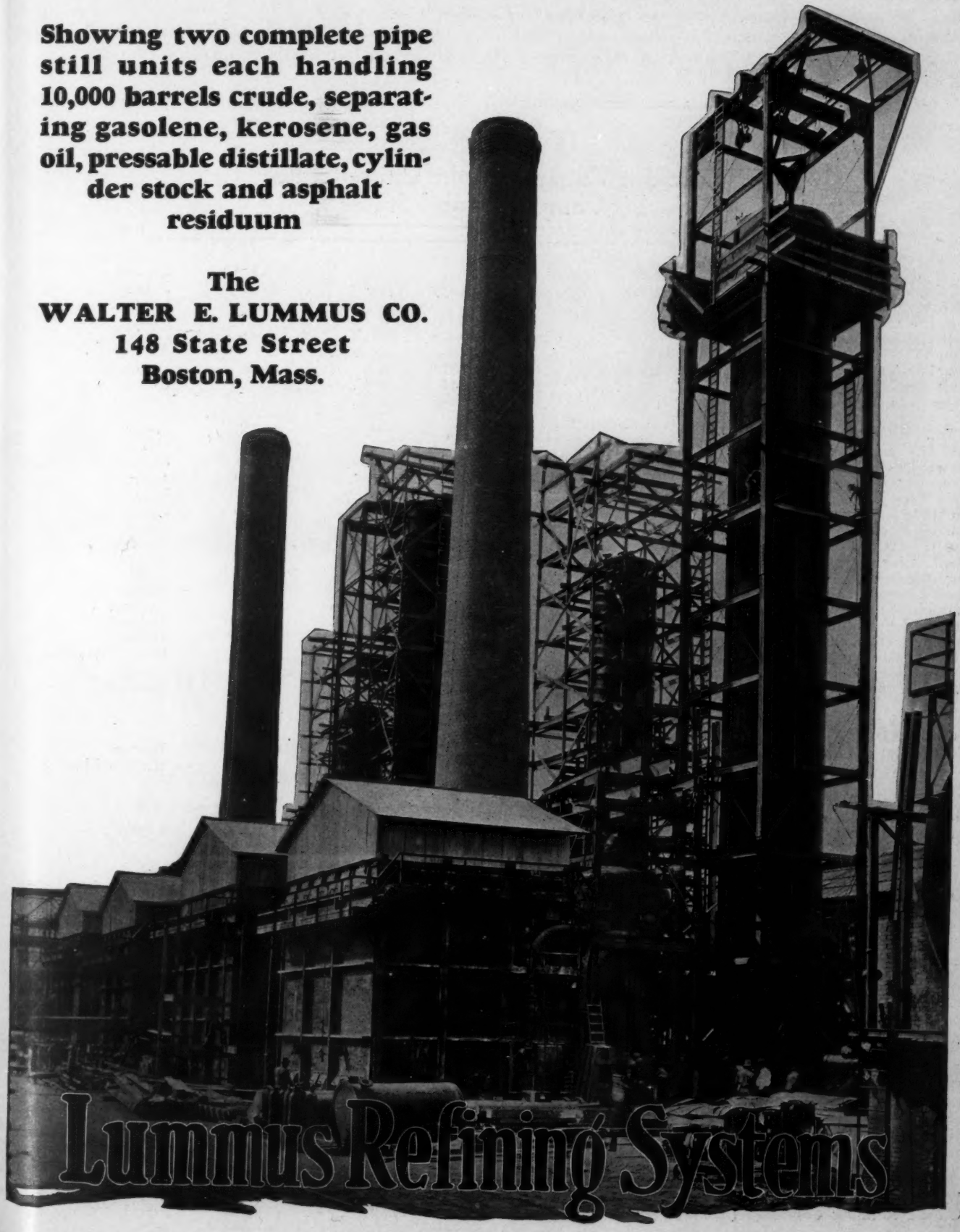

is at the rate of 1,011,625,385 barrels per year. At 40 per cent. gasoline recovery the refineries of this country some time next year will be able to produce gasoline at the rate of 404,650,154 barrels annually. Since the estimated demand for 1929 is 393,000,000 barrels of gasoline, the possible production of 404,000,000 barrels, in round numbers, for 1930, does not seem much out of line. This line of reasoning points to the justification of the refining industry in its present expansion program.

Reports of new projects planned by many refining companies and not yet announced and the continuous improvement in refining equipment and expansion at the established refineries is indicative of the fact that the refining industry is at the present time engaged in a program of enlargement which will enable it to adequately take care of any increased demand for gasoline greatly above that of the present. Demand estimates projected ahead seem to justify and even to indicate actual necessity for such expansion.

TABLE 1

Cracking Capacity in the United States By Companies and States

Company	Location	Capacity	Type	Cracking Capacity	Type of Plant
ARKANSAS					
Houston Oil Company of Texas, Camden		3,000	S. & C.	3,000	Dubbs
Kettle Creek Refining Company, El Dorado		6,000	S. & C.	2,000	Dubbs
Lion Oil Refining Company, El Dorado		12,000	S. L. & C.	3,600	Burton
Ouachita Valley Refining Company, El Dorado		1,000	S. & C.	750	Dubbs
Root Refineries, El Dorado		10,000	S. & C.	2,000	Dubbs
Simms Oil Company, Smackover		2,500	S. & C.	2,000	Cross
Total 6 plants		34,500		13,350	
CALIFORNIA					
General Petroleum Corporation, Los Angeles		55,000	Complete	3,000	(Vapor Phase-Own)
Hercules Gasoline Company, Vernon		5,000	S. & C.	1,500	Jenkins
Italo Petroleum Corporation, Hynes		....	C.	500	Trumble
Richfield Oil Company (Pan-American) Wilmington		60,000	Complete	12,000	Cross-Black
Richfield Oil Company, Hynes		70,000	S. & C.	12,000	Cross
Rio Grande Oil Company, Vinvale		6,000	S. & C.	2,000	Jenkins
Shell Company of California, Martinez		42,000	Complete	16,000	Dubbs
Shell Company of California, Wilmington		63,000	Complete	17,600	Dubbs
Shell Company of California, Dominquez		....	Crack	21,600	Dubbs
Standard Oil Company (California), Bakersfield		25,000	S. & C.	250	Leamon
Standard Oil Company (California), El Segundo		100,000	Complete	15,000	Dubbs
Standard Oil Company (California), Richmond		100,000	Complete	20,000	Dubbs
The Texas Company, Watson		30,000	Complete	4,000	Holmes-Manley
Union Oil Company, Wilmington		55,000	Complete	15,000	Cross
Western Oil & Refining Company, Wilmington		10,000	S. & C.	3,500	Jenkins
Total 15 plants		621,000		143,950	
COLORADO					
Continental Oil Company, Florence		3,000	S. & C.	1,500	Burton
The Texas Company, Craig		750	Complete	500	Holmes-Manley
Total 2 plants		3,750		2,000	
GEORGIA					
Atlantic Refining Company, Brunswick		5,000	Complete	2,000	Lewis
Total 1 plant		5,000		2,000	
ILLINOIS					
Empire Oil & Fefining Company, Chicago		15,000	S. & C. est.	8,000	Doherty (Bldg)
Indian Refining Company, Lawrenceville		12,000	Complete	11,000	Cross-Dubbs
Globe Oil & Refining Company (re-bldg.), Lemont		1,500	S. D. S. & C.	1,500	Donelley S. D.
Lincoln Oil Refining Company, Robinson		6,000	Complete	7,000	Holmes-Manley
Lubrite Refining Company, E. St. Louis		3,000	S. & C.	1,200	Fleming
Shell Petroleum Corporation, Wood River		46,000	S. L. & C.	17,400	Dubbs-Cross
Standard Oil Company (Ind)., Wood River		20,000	Complete	23,000	Burton-Cross-Holmes-Manley
The Texas Company, Lockport		6,000	S. L. & C.	5,500	Holmes-Manley
White Star Refining Company, Wood River		5,500	S. & C.	2,600	Dubbs
Total 9 plants		115,000		77,200	
INDIANA					
Bartles-Maguire Oil Company, East Chicago		3,000	S. & C.	3,000	Jenkins
Shell Petroleum Corporation, East Chicago		27,000	S. & C.	8,000	Dubbs
Sinclair Refining Company, East Chicago		40,000	Complete	35,000	Isom
Standard Oil Company, (Ind), Whiting		66,500	Complete	60,000	Burton-Cross-Holmes-Manley
Total 4 plants		136,500		106,000	
IOWA					
Omaha Refining Company, (S. D.), East Omaha		1,500	S. & C.	1,500	(S. D.) Cross
Total 1 plant		1,500		1,500	

[Assembly shop and riveting floor showing 25 ton crane, Houston plant]

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Cracking Capacity in the United States

(Continued)

Company	Location	Capacity	Type	Cracking Capacity	Type of Plant
KANSAS					
Arkansas City Refining, (S. D.),	Arkansas City (S. D.)	6,000	Complete (S. D.)	1,400	Dubbs
Barnsdall Refineries, Inc.,	Wichita	4,000	S. & C.	2,500	Dubbs
Derby Oil Company,	Wichita	5,000	S. & C.	2,300	Dubbs
Golden Rule Refining Company,	Wichita	1,000	S. & C.	1,200	Jenkins
Grant Oil Company, (S. D.),	Augusta (S. D.)	2,500	S. & C.	1,000	Jenkins S. D.
Kanotex Refining Company,	Arkansas City	12,000	S. & C.	6,000	Jenkins
Independent Oil & Gas Company,	Kansas City (Manhattan)	7,000	S. & C.	2,750	Dubbs (Bldg.)
Miller Petroleum Company (S. D.),	Humboldt (S. D.)	2,000	S. & C.	600	Cross
Peerless Oil & Refining Company,	Chanute	3,000	S. & C.	3,500	Jenkins
Shell Petroleum Corporation,	Arkansas City	27,000	S. & C.	8,000	Dubbs
Sinclair Refining Company,	Coffeyville	10,000	Complete	10,000	Isom
Sinclair Refining Company,	Kansas City	8,000	S. L. & C.	10,000	Isom
Skelly Oil Company,	El Dorado	23,000	S. & C.	13,000	Cross-Jenkins Winkler-Koch
Standard Oil Company (Kans.),	Neodesha	15,000	S. & C.	12,000	Burton-Holmes-Manley
Vickers Petroleum Company,	Potwin	3,000	S. & C.	1,200	Dubbs
White Eagle Oil & Refining Company,	Augusta	10,000	S. & C.	2,500	Burton
Total 16 plants		138,500		77,950	
KENTUCKY					
Ashland Refining Company, Inc.,	Leach	4,000	S. & C.	1,200	Dubbs
Aetna Oil Service, Inc.,	Louisville	2,000	S. & C.	400	Fleming
Louisville Petroleum Refining Company,	Louisville	2,000	S. & C.	2,100	Dubbs
Latonia Refining Company,	Latonia	5,000	S. & C.	1,000	Tube & Tank
Standard Oil Company, (Ky.),	Louisville	5,000	S. & C.	3,000	Burton
The Texas Company,	Pryse	4,000	S. & C.	2,000	Holmes-Manley
Total 6 plants		22,500		9,700	
LOUISIANA					
Crystal Oil Refining Corporation,	Sedar Grove	7,500	S. & C.	3,000	Jenkins
Dixie Oil Company, Inc.,	Superior	3,000	S. & C.	2,000	Cross
Louisiana Oil Refining Corporation,	Bossier City	25,000	S. A. & C.	14,000	Tube & Tank
Shell Petroleum Corporation,	Norco	20,000	S. A. & C.	10,000	Dubbs
Shreveport-El Dorado P. L. C.,	Jewella	10,000	S. & C.	10,500	Dubbs-Jenkins
Standard Oil Company, (La.),	Baton Rouge	80,000	Complete	40,000	Burton-Cross Tube & Tank Link
Total 6 plants		145,000		79,500	
MARYLAND					
Interocean Oil Company of Del.,	Baltimore, (S. D.)	7,000	S. L. & C.	2,000	Leamon-Dubbs
Prudential Oil Corporation, (Marland),	Fairfield	10,000	Complete	7,000	Cross-Dubbs
Standard Oil Company, (N. J.),	Baltimore	32,000	Complete	51,600	Tube & Tank-Burton
Total 3 plants		49,000		60,600	
MASSACHUSETTS					
Beacon Oil Company,	Everett	25,000	S. A. & C.	20,000	Tube & Tank
Cities Service Refining Company,	East Braintree	15,000	Complete	2,800	Holmes-Manley Doherty
Total 2 plants		40,000		22,800	
MICHICAN					
White Star Refining Company,	Trenton	5,000	S. & C.	3,050	Dubbs (Bldg.)
Total 1 plant		5,000		3,050	
MISSOURI					
Standard Oil Company, (Ind),	Sugar Creek	15,000	Complete	15,000	Holmes-Manley Burton
Wilhoit Refining Company,	Joplin	1,500	S. & C.	1,200	Jenkins
Total 2 plants		16,500		16,200	
MONTANA					
Arro Oil & Refining Company,	East Lewistown	2,600	S. & C.	800	Dubbs
Total 1 plant		2,600		800	
NEW JERSEY					
Barber Asphalt Company,	Mauer	5,000	Complete	2,500	Cross *1
Crew-Levick Company,	Petty Island	4,000	S. & C.	2,000	Doherty *2
Gulf Refining Company,	Bayonne, N. J.	30,000	S. & C.	1,000	De Flores
Standard Oil Company, (N. J.),	Bayonne	88,000	Complete	44,000	Tube & Tank, Burton
Standard Oil Company, (N. J.),	Linden	75,000		117,700	Tube & Tank, Burton
Tide Water Oil Company,	Bayonne	60,000	Complete	12,000	Tube & Tank, Burton
Vacuum Oil Company,	Paulsboro	15,000	Complete	11,500	Tube & Tank, Cross
Warner-Quinlan Company,	Warners	8,000	S. & C.	1,500	Dubbs
Total 8 plants		285,000		192,200	

*1—Owned by—Bertin Petroleum Company.
*2—Owned by—Eastern Oil Processing Company.

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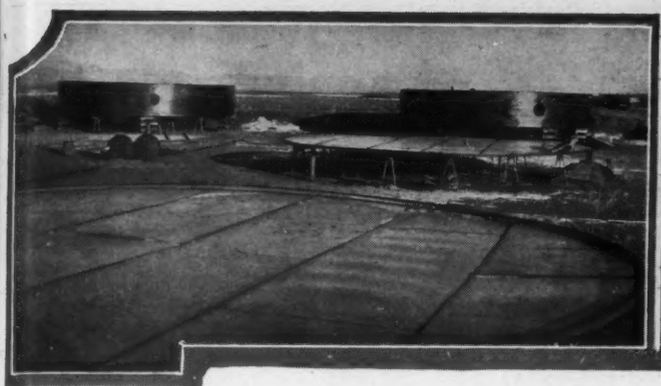
Oil Burners and Oil Burning Equipment

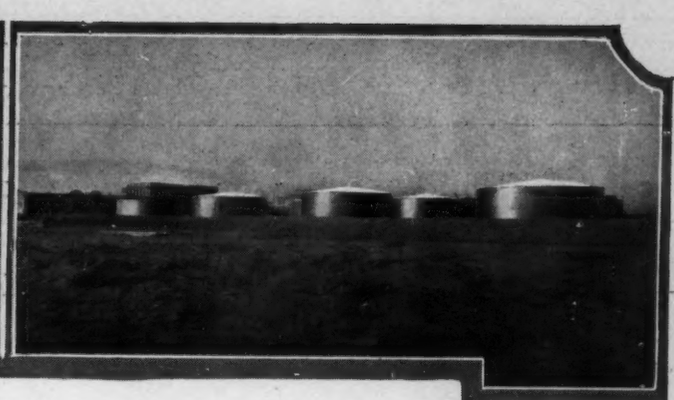
Cracking Capacity in the United States

(Continued)

Company	Location	Capacity	Type	Cracking Capacity	Type of Plant
NEW YORK					
Standard Oil Company, (N. J.), Greenpoint		25,000	Complete	8,000	Cross
Standard Oil Company, (N. Y.), Buffalo		3,500	Complete	2,000	Cross
Vacuum Oil Company, Olean		7,000	Complete	4,000	Tube & Tank, Cross
Total 3 plants		35,500		14,000	
OHIO					
Paragon Refining Company, Toledo		10,000	Complete	5,000	Dubbs
Pure Oil Company, Heath		5,000	S. & C.	6,000	Cross
				1,000	Gyro
Solar Refining Company, Lima		18,000	Complete	12,000	Burton-Cross
Standard Oil Company, Cleveland		12,000	Complete	8,500	Tube & Tank
Standard Oil Company, Toledo		12,000	Complete	4,000	Tube & Tank
Steller Refining Company, Marne		1,000	Complete	500	Leamon
Total 6 plants		58,000		37,000	
OKLAHOMA					
Barnsdall Refineries, Inc., Barnsdall		6,000	Complete	4,000	Cross
Barnsdall Refineries, Inc., Okmulgee		11,000	S. & C.	4,000	Cross
Bell Oil & Gas Company, Brandfield		3,500	S. & C.	1,200	Dubbs
Bolene Refining Company, Enid		5,000	S. & C.	2,000	Jenkins
Champlin Refining Company, Enid		16,000	Complete	4,000	Cross
Continental Oil Company, Sapulpa		10,000	S. & C.	3,600	Cross
Empire Refineries, Cushing		5,000	S. & C.	1,500	Doherty
Empire Refineries, Okmulgee		4,000	Complete	1,000	Doherty
Empire Refineries, Ponca City		7,500	Complete	6,000	Doherty-Dubbs
Garber Refinery, Inc., Garber		4,000	S. & C.	1,000	Jenkins, *1
Globe Oil & Refining Company, Blackwell		8,000	S. & C.	1,000	Cross
Globe Oil & Refining Company, Cushing		5,000	S. & C.	4,000	Jenkins
Imperial Refining Company, Ardmore		6,000	S. & C.	2,200	Dubbs
Independent Oil & Gas Company, Okmulgee		8,000	S. L. & C.	2,500	Jenkins
Johnson Oil Refining Company, Cleveland		8,000	S. & C.	4,000	Dubbs
Marland Refining Company, Ponca City		27,000	Complete	19,600	Dubbs-Cross-Fleming
Mid-Continent Petroleum Corporation, West Tulsa		40,000	Complete	12,000	Own-Coast Koontz
Pierce Petroleum Company, Sand Springs		8,000	Complete	4,000	Cross
Producers & Refiners Corporation, West Tulsa		6,000	S. & C.	3,000	Dubbs
Pure Oil Company, Ardmore		7,000	S. & C.	2,600	Dubbs
Pure Oil Company, Muskogee		8,000	Complete	4,000	Cross
				1,000	Gyro
Shaffer Oil & Refining Company, Cushing		10,000	Complete	3,500	Dubbs
The Texas Company, West Tulsa		14,000	S. L. & C.	16,800	Holmes-Manley
Texas Pacific Coal & Oil Company, Wynnewood		3,000	S. & C.	1,000	Dubbs
Tidal Refining Company, Drumright		10,000	S. & C.	3,000	Tube & Tank
Transcontinental Oil Company, Bristow		5,000	S. & C.	1,350	Slagter
Transcontinental Oil Company, Boynton		2,500	Complete	900	Slagter
Western Oil Corporation, Duncan		2,000	S. & C.	1,500	Jenkins *2
White Oak Refining Company, Allen		8,500	S. & C.	1,500	Jenkins
Wilcox, H. F. Oil & Gas Company, Bristow		1,000	S. & C.	1,000	Dubbs
Total 30 plants		259,000		118,750	
*1—Cracking Unit Operated by Bilmont Refining Co.					
*2—Cracking Unit Operated by Beckett Company, Inc.					
PENNSYLVANIA					
American Oil Works Company, Titusville		1,000	S. L. & C.	200	Fleming
Atlantic Refining Company, Franklin		9,000	Complete	6,000	Cross-Lewis
Atlantic Refining Company, Philadelphia		50,000	Complete	32,000	Cross-Lewis
Atlantic Refining Company, Pittsburgh		8,000	Complete	4,000	Cross
Butler County Oil Refining Company, Bruin		1,000	Complete	400	Bruin.
Crew Levic Company, Petty Island		2,000	Skimming	1,200	Doherty *1
Emlenton Refining Company, Emlenton		1,500	Complete	250	Snodgrass
Freedom Oil Works Company, Freedom		2,000	Complete	500	Dubbs
Independent Refining Company, Oil City		1,500	Complete	400	Conerty
The Island Petroleum Company, Neville Island		1,000	Complete	300	Snodgrass
Kendall Refining Company, Bradford		3,500	Complete	1,000	Dubbs
Mutual Refining Company, Warren		750	Complete	1,100	Snodgrass
Pennsylvania Oil Products Refining Co., Eldred		1,500	Complete	1,000	Conerty
Pennzoil Company, Oil City		7,000	Complete	2,000	Dubbs
Pure Oil Company, Marcus Hook		17,000	Complete	8,000	Cross
				3,000	Gyro
Swan-Finch Oil Corporation, Warren		1,000	Complete	250	Snodgrass
Sinclair Refining Company, Marcus Hook		16,000	Complete	20,000	Isom
Sun Oil Company, Marcus Hook		25,000	S. A. & C.	12,000	Cross
Titusville Oil Works, Titusville		1,000	Complete	200	Fleming
Waverly Oil Works Company, Coraopolis		3,000	Complete	2,000	Cross
Waverly Oil Works Company, Pittsburgh		1,000	Complete	1,000	Cross
Total—21 Plants		153,750		96,800	

*1—Owned by Eastern Oil Processing Company.





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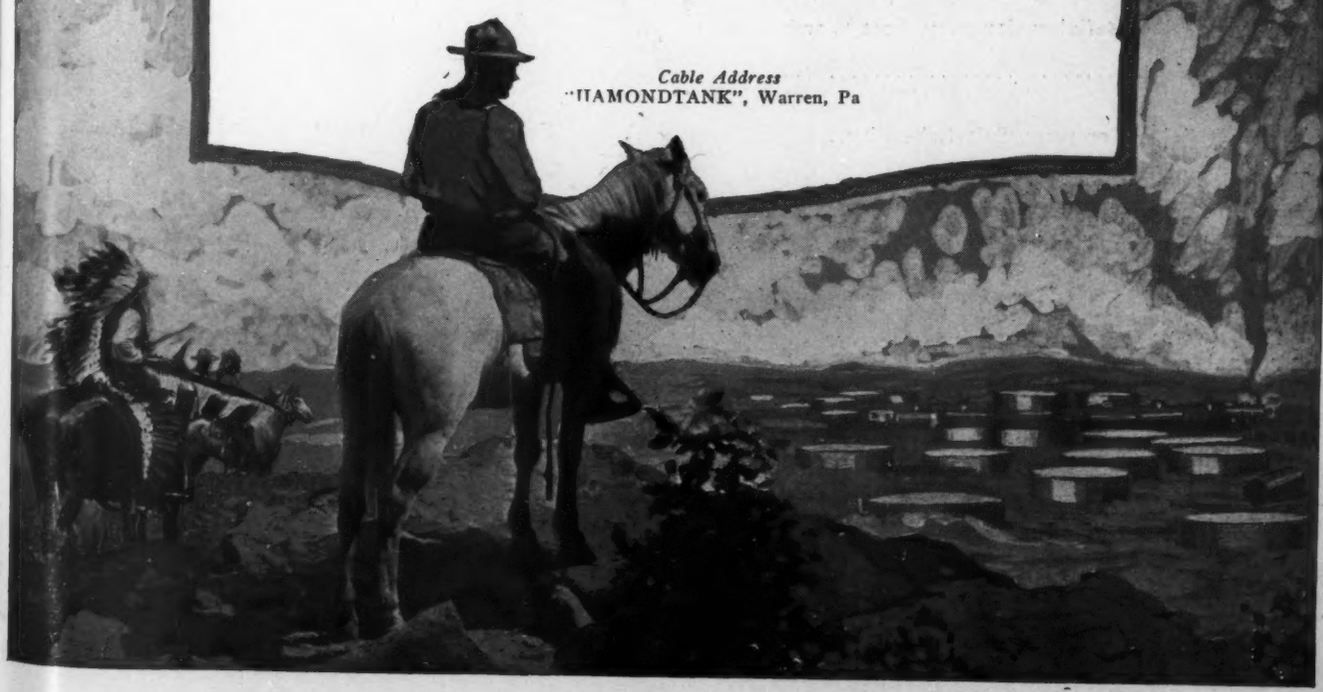


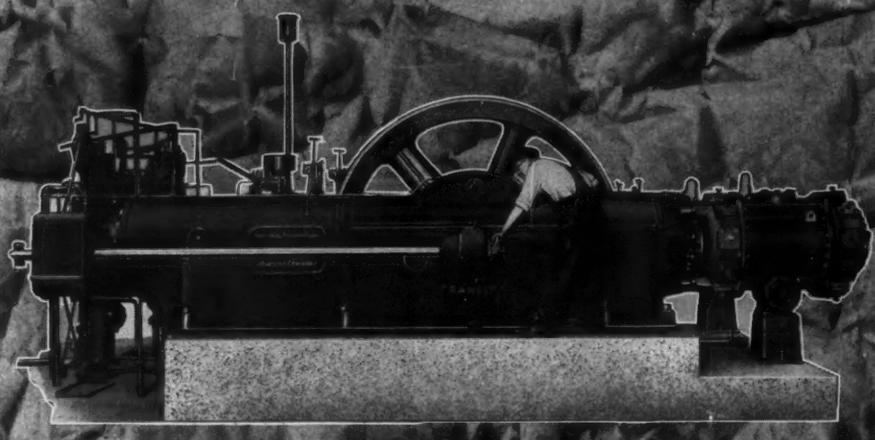
Cracking Capacity in the United States

(Continued)

Company	Location	Capacity	Type	Cracking Capacity	Type of Plant
RHODE ISLAND					
Standard Oil Company, (N. Y.), E. Providence		10,000	S. A. & C.	10,000	Cross
Total—1 Plant		10,000		10,000	
SOUTH CAROLINA					
Standard Oil Company, (N. J.), Charleston		15,000	S. A. & C.	34,400	Tube & Tank, Burton
Total—*1 Plant		15,000		34,400	
TEXAS					
American Refiner Properties, Wichita Falls		7,000	S. & C.	2,300	Cross-Dubbs
Burford Oil Company, Pecos		7,000	S. & C.	4,000	Jenkins
Continental Oil Company of Texas, Wichita Falls		3,500	S. & C.	2,400	Dubbs
Cosden & Company, Big Springs		10,000	S. & C.	6,000	Jenkins
Crown Central Petroleum Corporation, Houston		5,000	S. L. & C.	5,000	Holmes-Manley
Empire Oil & Refining Company, Gainesville		6,000	S. & C.	7,000	Doherty-Dubbs
Grayburg Oil Company, San Antonio		5,000	S. & C.	2,400	Dubbs
Great West Refining Company, Big Springs		7,500	S. & C.	1,500	Rowsey
Gulf Refining Company, Fort Worth		6,000	S. & C.	5,000	Gulf
Gulf Refining Company, Port Arthur		125,000	Complete	70,000	Gulf
Gulf Refining Company, Sweetwater		5,000	S. & C.	4,000	Gulf
Humble Oil & Refining Company, Ingleside		15,000	S. & C.	15,000	Tube & Tank
Humble Oil & Refining Company, McCamey		15,000	S. & C.	15,000	Tube & Tank
Humble Oil & Refining Company, Baytown		100,000	S. L. & C.	110,000	Tube & Tank
Iowa Park Producing & Refining Company, Iowa Park		2,500	S. & C.	1,500	Jenkins (Bldg.)
Magnolia Petroleum Company, Beaumont		77,000	Complete	44,000	Cross-Burton
Magnolia Petroleum Company, Fort Worth		5,000	S. & C.	3,000	Cross
Motor Fuels Producing Company, Laredo		1,000	S. & C.	1,200	Jenkins
LaSalle Petroleum Company, Burkburnett		3,500	S. & C.	1,500	Jenkins (Bldg.)
Panhandle Refining Company, Wichita Falls		5,000	S. & C.	1,500	Dubbs
Pure Oil Company, Smiths Bluff		3,000	S. & C.	13,000	Cross
				3,000	Gyro
Richardson Refining Company, Big Springs		5,000	S. & C.	2,000	Jenkins (Bldg.)
Simms Oil Company, W. Dallas		4,500	S. & C.	2,000	Cross
Shell Petroleum Corporation, Houston		20,000	S. & C.	10,000	Dubbs (Bldg.)
Sinclair Refining Company, Sinco		23,000	S. & C.	20,000	Isom
Star Refining & Producing Company, Fort Worth		1,500	S. & C.	200	Fleming
Terminal Oil & Refining Co., (S.D.), Texas City		2,500	S. D. S. & C.	1,500	S. D.
Taxman Refining Co., (S.D.), Wichita Falls		2,000	S. & C.	600	Cross S. D.
The Texas Company, San Antonio		3,000	S. & C.	3,300	Holmes-Manley Bldg.
The Texas Company, El Paso		1,500	S. & C.	1,650	Holmes-Manley Bldg.
The Texas Company, Port Arthur		60,000	Complete	79,200	Holmes-Manley
The Texas Company, West Dallas		16,000	Complete	3,600	Holmes-Manley
The Texas Company, (Galena), Houston		10,000	S. & C.	4,000	Tube & Tank
Transcontinental Oil Company, Fort Worth		5,000	Complete	1,350	Slagter
Texas Pacific Coal & Oil Company, Fort Worth		3,000	S. L. & C.	1,000	Cross
White Eagle Oil & Refining Company, Fort Worth		5,000	S. & C.	1,000	Holmes-Manley
Total—36 plants		576,000		459,700	
UTAH					
Utah Oil Refining Company, Salt Lake City		6,000	Complete	9,000	Holmes-Manley Benton
Total—1 Plant		6,000		9,000	
WEST VIRGINIA					
Carbide and Carbon Chemicals, S. Charleston		.....	Crack	1,500	Gyro
Ohio Valley Refining Company, St. Marys		1,800	Complete	300	Snodgrass
Pure Oil Company, Cabin Creek		3,000	S. L. & C.	1,500	Gyro
Standard Oil Company, (N. J.), Parkersburg		4,000	Complete	10,250	Tube & Tank
Tri-State Refining Company, Kenova		2,500	S. L. & C.	2,000	Jenkins
Total—5 Plants		11,300		15,550	
WYOMING					
Continental Oil Company, Glenrock		10,000	S. & C.	3,600	Burton
Egaso Holding Corporation, (S. D.), Osage (S. D.)		1,000	S. & C. (S. D.)	1,000	Cross (S. D.)
Midwest Refining Company, Greybull		10,000	S. A. & C.	15,000	Burton
Midwest Refining Company, Laramie		3,500	S. & C.	4,500	Burton
Midwest Refining Company, Casper		50,000	Complete	30,000	Burton
Producers & Refiners Corporation, Parco		12,000	S. L. & C.	3,300	Dubbs
The Texas Company, Casper		7,000	S. & C.	9,400	Holmes-Manley
The Texas Company, Cody		3,000	S. & C.	2,000	Holmes-Manley
White Eagle Oil & Refining Company, Casper		4,000	S. & C.	2,500	Holmes-Manley
Total—9 Plants		100,500		71,400	

TRANSIT

17x24 Gas Engine Compressor



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DEALING IN PERSONALITIES

ARTHUR'S VASES IN THE VILLA KNAPP

Arthur Knapp, Petroleum Expert and Economist for United Gas Improvements Company, Philadelphia, engineer, contributor to the petroleum industry trade press, and vice chairman for Division of Economics, American Institute of Mining and Metallurgical Engineers, and a number of other things, still has time to plan, design and look after the building of his home, and to nestle it snugly on the cool side of a New Jersey hill. Then Arthur landscapes his place, puts in carefully designed flower beds and raises flowers from, apparently, any place on earth. Again, he did an excellent job as interior decorator and finished his home inside to suit his taste, then decorated the wall with his own oil paintings. But the crowning glory is the vases. On every thing there is a vase. The bulbous lower part of each, whether placed on mantle, book case, piano or cabinet, was apparently designed for the maximum capacity of burnt matches and dead smokes.

The visitor's first instructions at "Villa Knapp" are to throw the "smoker's litter" into the handiest vase. Mighty easy to feel at home—where a vase don't demand the usual awesome respect.

NUMBER TWO

Back in 1912-13 Alfred Mullhaupt was in the employ of the Kendall Refining Company conducting experiments in cracking distillates from the Bradford, Pennsylvania, crude oil. He has been with this same company again for the past year or so, as refinery engineer. The old cracking units where Alfred experimented 16 years ago are now converted into a battery of very efficient re-run stills with bubble towers, handling pressure distillate from the plant's Dubbs units.

Golf is a he-man's game at the Crew-Levick refinery at Petty Island, Philadelphia. Clubs and paraphernalia required for the noontime pastime of the employes consist of a five-pound steel ball, replacing the common "Kro-flite," an eight-pound sledge for short approaches and putts, and a substantial derrick for removing the ball after having holed out, in one of the four-inch nipples.

To the left is a man in the "rough," getting ready to use an eight-pound "sky-iron" to get over a joint of pipe.

BEAUTY JUDGED!

Superintendent R. D. McClaran and Assistant Superintendent E. E. McPherson, of the Pure Oil Company's Heath Refinery, Neward, Ohio, have, for some years, fathered the ideas of welfare work at the plant where they are in charge. They push any idea through to completion which may bring about a more beautiful, or more efficient plant, or better working conditions for the associated employee. The Foremen's welfare council, the safety committee, the ball teams, playgrounds and splendidly landscaped "front yard" at the plant, as well as the beautifully kept homes, well kept, as the result of the annual "home beautification contest" are evidences of the continued welfare endeavor.

The team of McClaren and McPherson is cordial to visitors and will even extend the privilege of enjoying a smoke in the superintendent's office. In return they will likely put the visitor to work and make him jeopardize his life by judging the homes of employees who take part in the home beautiful contest. The writer had to be one of the judges to select the winner of the annual ten dollar bill. He left town that afternoon.

PIONEERS?

Transcontinental Oil Company was operating a pair of tube stills in 1920. Eight years ago this company's refinery at Boynton, Oklahoma, was equipped with pipe stills and fractionating columns in series and operating continuously.

And in addition to continuous distillation of crude oil it was making cylinder stock with its tube still and towers system, also continuously.

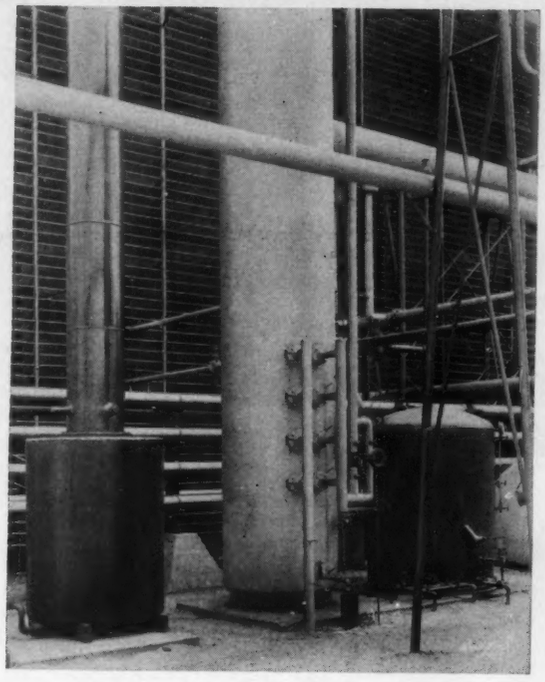
This was even before the "tower" was fully accepted by the industry. It was three or four years later before refiners credited the pipe still with any advantages over the shell still.

Further, the Transcontinental plant was equipped with early type of vapor heat exchangers in 1920. An improved type of vapor heat exchangers was installed in 1922. Six years ago this plant started utilizing and conserving heat formerly wasted.

A. J. Slagter, when he told the writer about these things, laid no claim to pioneering such innovations in the industry, stating at the same time that he knew of vapor heat exchangers being employed by certain California refiners in 1915-16.

However, there is no doubt that Transcontinental Oil Company was among the earliest to adopt continuous distillation, to produce cylinder stock with the pipe still, and to place heat exchangers on shell still vapor lines.

Billions of Bubbles



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Yet, but how?

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Recovery	91%
Butane content	33%

Mildly interesting, isn't it?

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MID-CONTINENT AGENCY

Originators of Oil-Froth Absorbers

Efficient and Economical Handling of Packing

By R. A. BOYD
Before Columbian Gasoline Corporation Foremen's Meeting

ONE of the major expenses of any plant is packing. As a usual thing, very little attention is paid to the type, method of installation or for what service the packing is really designed. The packing is simply bought; turned over to the plant operators, and it is left to their judgment as to method of installing and as to whether or not it is a good packing.

Packings are made up of several different materials, some of which are flax, cotton, rubber, asbestos, soft metals and jute. Each of these materials have characteristics which make them better for one service than another.

As there are certain conditions which the packing must meet, such as temperature, condensation, pressure, vacuum and corrosive substances, also rotary, reciprocating and lateral motions, some thought must be given as to just what type packing should be used to meet these conditions.

All packings are made up and then lubricating compounds are forced into them under pressure and heat, each packing manufacturer uses different lubricating compounds, the formulas of which are very closely guarded secrets.

If the packing is used on steam pistons, the amount of condensation and the steam pressures should be determined and a packing to meet these conditions used. If 125 pounds of steam pressure is used, a packing designed for 200 pounds should not be used, as the packing for the higher pressure would possibly be made of a harder material which would be harder on the rods. Packings that will give good results on reciprocating rods with little wear would probably score the shaft of a rotary pump and give very poor service.

Precautions

When a rod is packed, care should be taken to see that the stuffing box gland is clean and free from any small pieces of old packing, then the packing rings should be put in and tamped firmly into the box until it is nearly filled, care being taken that all joints are broken. The gland nuts should be pulled up lightly with a wrench to make sure the packing has seated properly, then loosen the nuts and run up finger tight. The nuts should be loosened up as the packing expands after the machine is started. Many sets of packing are ruined by being tightened up too tight when it is first installed, due to the expansion of the packing, making it much tighter in the stuffing box and breaking down the body of the packing.

Still other sets are spoiled by not being taken care of properly after they have been installed by being allowed to blow until grooves are cut through the packing. When this happens it is very hard to stop the leak, and the leak is usually stopped at a great sacrifice in the length of the life of the packing. Other sets are ruined by being improperly installed.

As in the case of diagonal cut packing, it should always be installed with the inside or wedge shaped ring towards the pressure, as in this way when the pressure comes on, the wedge shaped ring has a tendency to hug the rod and the outside ring will be forced against the stuffing box wall and form a better seal. Then on the return stroke when the pressure is released the packing will have a tendency to release the rod, and in this way make the machine run better and increase the life of the packing.

Very often a gland starts leaking and it is decided that it needs repacking. When packing is taken out it should be carefully inspected and any rings that are good should be used again. The new rings should be put in the bottom of the box and the old rings should go in last. In this way the new rings will be in the place where the hardest work is to be done and the old rings should last practically as long as the new ones.

Most all packing has graphite in it, and after it is run for some time this graphite forms a glaze on the packing next to the rod. This glaze, if the packing has not become hardened, it is claimed, will not score the rod or plunger.

Wasteful Habits

At times the old packing will be taken out and thrown in the trash can and a complete new set will be installed. Quite often the installation of one new ring is sufficient to stop a gland from leaking. The habit of throwing away all of the old packing is a very wasteful and expensive one. Of course there is a time when all of the old packing should be thrown away, but this is a very hard thing to lay down fixed rules on, due to different conditions under which the packing is used, for if the old packing becomes hardened by vulcanizing or crystallizing it will cut the rods.

Great care should be taken in the care of stud bolt glands to see that they are not cocked, for as a usual thing these glands are a very snug fit around the rod or plunger, and if they are cocked a very little, the end of the gland that goes into the stuffing box will ride the rod and score it. Then, of course, the scored rod is blamed on the packing, but never on the gland.

Another practice very common among operators is to see a set of packing leaking and to take a wrench and tighten up on the nuts, with the machine running, that are easiest to get to, with the result that the bottom nut on the inside is left loose. This will cock the gland and cause trouble. It is much easier to take care of rods and keep them from becoming scored than it is to pack scored rods and keep them from leaking. Inside calipers should always be used when tightening up a stud bolt gland, especially the larger ones.

The practice of tightening up on a gland while the machine is running is dangerous. If on steam, the packing when tightened, may blow out and scald the man, or he may get his hand caught between the gland and cross-head and be badly injured, or the wrench may get caught in the machine and tear up the rods or break the machine, as has frequently happened.

More rods and plungers are scored by the rods or plungers dropping down on the glands, or by the glands being improperly aligned when packing is installed or being pulled out of line during the life of the packing, then by the hardening of the packing.

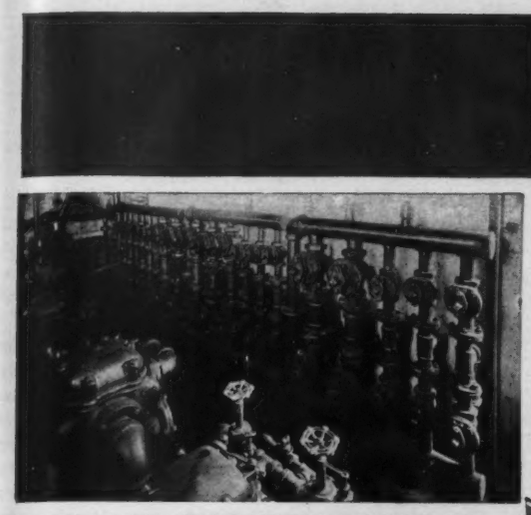
Lubrication of Plungers

The proper lubrication of rods and plungers is very essential, for after a time the heat of the rod will cause most of the lubricant to run out of the packing and it should be swabbed at frequent intervals with oil. This will keep the rod in good condition and prolong the life of the packing, also make the machine run more efficiently and economically.

A very good thing to use on plungers and rods is cup grease with a higher melting point than the temperature of the rod, as the cup grease will not run off the plungers or rods as quickly as oil.

In packing small valve stems with twisted rope packing, where the gland is threaded onto the steam chest, or on any valve with a screwed gland, very little attention, as a general rule, is paid to the way the packing is wound onto the stem, with the result that when the gland is screwed on, the packing balls up in the stuffing box and a very poor job of packing is done.

Rope packing should be wound onto the stem in the direction that the gland screws, and as each turn is wound on



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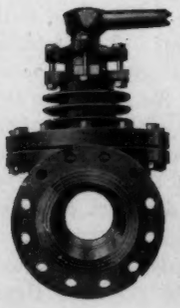
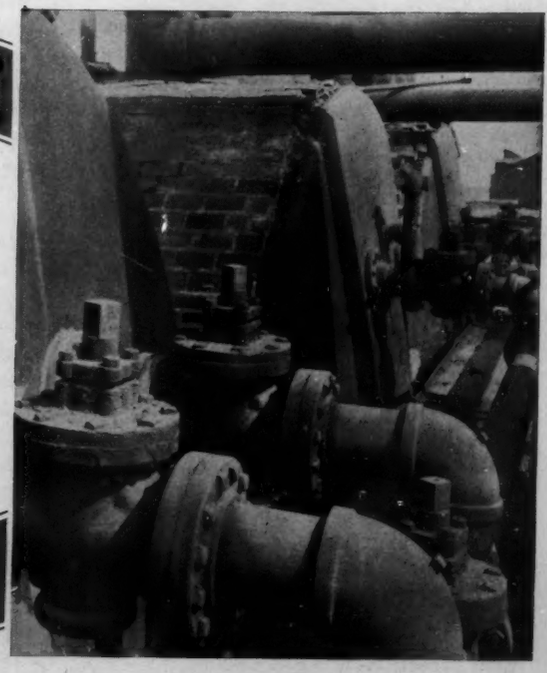


Cast steel, round port valve for temperatures up to 750° and pressures up to 300#. Carbon deposits easily cleaned from valve and line.



it should be pressed firmly into the stuffing box. By winding the packing in this way when the gland is tightened up it will have a tendency to pull it tight around the rod and at the same time press it firmly into the stuffing box.

On all flange gaskets the flanges should be absolutely clean and true, and the gasket should be so cut and centered so that no portion of the gasket projects beyond the flange into the liquid or gas that may be passed through the pipe.

Very often gaskets are cut with a too small inside diameter, with the result that they are washed or torn away and carried along the pipe to the engines or pumps where they cause the valves to stick, the pit cocks to become stopped up, and many other troubles.

After gaskets are installed, it is very good practice after the lines start warming up and the flange bolts become heated and expanded, to go over them and re-tighten them, as this will very often prevent blowing out and will compress the gaskets so that no moisture can soak into them and cause a blow-out.

Very many gasket replacements could be avoided by this practice. Also, quite a saving in time and material could be effected, not only in the cost of gasket material but, as in the case of steam lines where the insulation must be removed to make the repair, the labor and material necessary to replace the installation could be saved and very often shutting down avoided.

In cutting sheet packing care and judgment should always be used to use as little packing as possible. Make the required gasket with as little waste as possible. Never should a small gasket be cut out of the center of a large sheet. Use up small scraps of sheet in cutting small gaskets.

Woven asbestos gaskets for boilers should never be used over as many times as possible. By sticking the gasket to the man or hand hole plate and using oil or grease and graphite between the gasket and boiler shell and being careful to always but the plate in the same way it came out, the gasket will become hard and glazed and will be about like a ground joint, and can be used over for a number of times.

A very small supply of packing should be ordered at one time, as the rubber in the packing deteriorates from being exposed to light, from age. When exposed packing is used, it doesn't last as long and runs the packing cost up on the plant.

Packing in the store room should always be kept in boxes, and boxes kept closed to keep the dirt out of it. See that the packing is not mixed up, as each packing is constructed to do a certain work and, if not used in the proper place, may cause some damage to rods, or will not give service.

Quigley Furnace Specialties Company, manufacturers of high-temperature cements, protective coatings and other industrial products, has moved its main office from 26 Cortlandt Street to the Lakner Building, 56 West Forty-fifth Street, New York City.

Mid-Continent Petroleum Corporation Employees Athletic Club

OUTSTANDING among the athletic departments of the various oil companies in Tulsa is the Mid-Continent Petroleum Athletic Club, made up of employees of the Mid-Continent Petroleum Corporation. Since its organization nearly three years ago it has had a large growth, with 1928 showing the largest increase. During this year its membership increased from 250 to 650.

The goal of the club from the beginning has been to construct a building, or buildings, in or near the company's refinery at West Tulsa, which would include a complete modern gymnasium, swimming pool, auditorium, library and club rooms. It is hoped that some time during 1929 work may be started upon the construction of these projects. The purpose of the organization is to promote the physical and social welfare of every employe. The value of such work in the promotion of fellowship, physical and social welfare of employees can readily be seen.

The company formerly operated a cafeteria on the second floor of one of its warehouses in West Tulsa. When this was abandoned the Athletic Club took it over and is now using it. Nearly a thousand dollars worth of athletic equipment is owned by the club. The fund for the construction of the proposed gymnasium is growing rapidly. Such money is secured from the membership dues and profits from the entertainments.

The club is active along several lines of entertainment. The most important of which is boxing. During warm weather outdoor matches are held once a month in an arena at the West Tulsa Refinery. These matches are open to the public and several thousand turns out each fight night. Smaller boxing matches are staged in the old cafeteria building during the winter.

The baseball team won the first half championship in the City League, but lost out to the second half winners in the play off. The two baseball diamonds maintained at the refinery, perhaps offer the members of the Athletic Club their greatest enjoyment. A playground baseball league has been organized in the company, with any department desirous of entering a team included in the schedule.

A three-hole golf course has been constructed and is maintained by the club at the West Tulsa refinery. It is hoped to enlarge this during the coming year. In addition the two tennis courts, horse-shoe pitching grounds, and others, were popular recreations with the members. The International Petroleum Exposition's "tug-o-war" contest was won by the Mid-Continent's club team.

Indoor sports are rather limited by the lack of adequate facilities, but wrestling, boxing, volley ball, hand ball and basketball are played. The company's basketball team is one of the best in the fast City League.

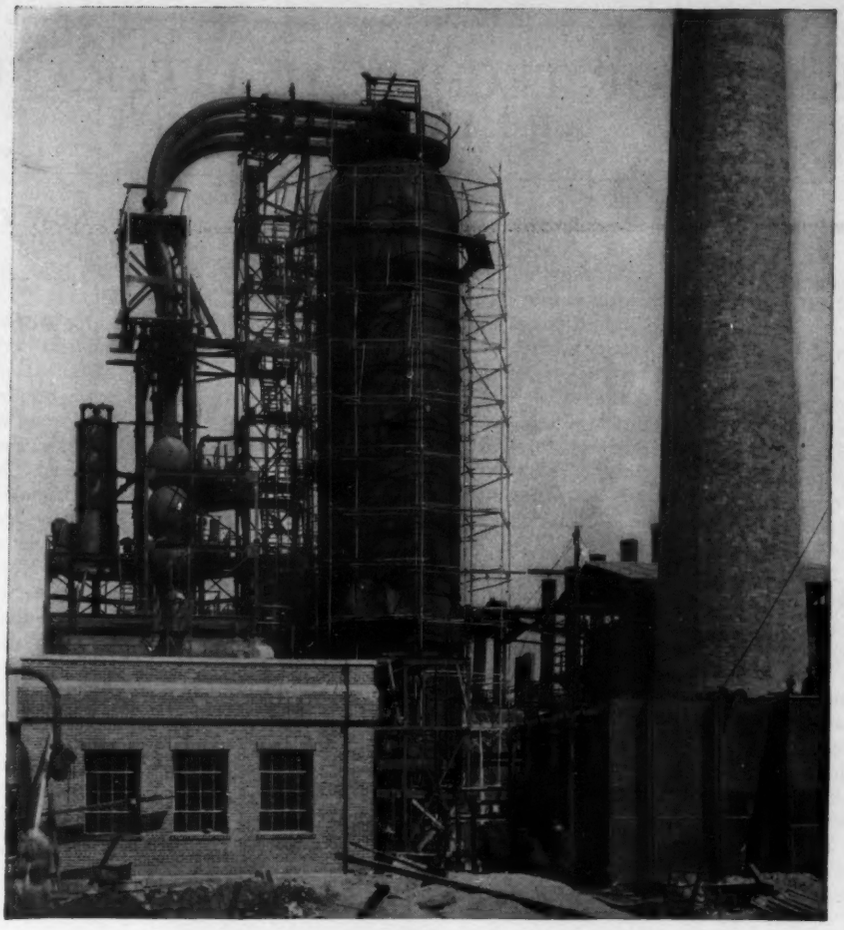
Among the social activities of the club are included—two dances monthly during the winter; a picnic each year in the Sand Springs park, which attracts thousands of employees and their friends; a Christmas tree for children of the employees, and other activities that they may decide upon during the year.

The latest function of the club was the staging of a mid-night ice-skating party in Tulsa's new ice coliseum. The coliseum was leased from 11:30 p. m. to 2:30 a. m. and limited to employees of the Mid-Continent Petroleum Corporation and their friends. Tickets were sold at the regulation price for public skating. A feature of the party was a farce hockey game between several teams composed of employees. Much amusement was furnished the spectators by the spills of the players as they rushed over the ice with child-size sweeping brooms after a small rubber ball, which were used in place of the regular hockey sticks and puck.

Present officers of the Mid-Continent Petroleum Athletic Club are as follows: J. W. Grays, president; B. H. Davis, vice-president and George F. Beatty, secretary-treasurer. The directors are L. J. McLaughlin, city office; D. L. Jacobs, engineering department; P. L. Pillars, pipe department; Dick Elkins, operating department; Jess Lyons, mechanical department; R. Rector, operating department; W. E. Getsman, laboratory; S. P. O'Brien, construction; N. A. Taylor, city office; and S. Mabry, laboratory.

Frank W. Hoyt, formerly associated with Nat D. Stevens at Wilkesbarre, Pennsylvania, selling power plant equipment, is now representing the Edward Valve & Manufacturing Company in the anthracite coal section, with offices in the Markle Bank Building, Hazleton, Pennsylvania, in his association with the Coxe Stoker Engineering Company.

White Eagle Oil & Refining Company, Kansas City, plans to enlarge capacity of its Casper refinery. Present capacity is 3000 barrels daily. Additional crude supply has been secured to justify expansion of the plant.



Vacuum Distilling Units

A complete refining unit for reduced crude, designed and erected by Foster Wheeler Corporation, is shown by the above illustration. It includes the largest vacuum fractionating tower in the world.

The pump house is located in the left foreground with the Foster heat exchangers shown above it. A section of the Foster tube still is visible behind the radial brick chimney. A Foster air preheater is placed in the gas passage between the still and the stack. This preheats the air for combustion, giving more efficient overall operation of the still.

The tube still receives 6250 barrels per day of topped Mid-Continent crude, and reduces it to 6-7 per cent bottoms. Overhead from the fractionating tower is gas oil, with side streams of pressible paraffin distillate, paraffin slop, overhead cylinder stock and asphalt bottoms.

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ABSTRACTS OF TECHNICAL LITERATURE

By H. L. KAUFFMAN

Testing and Analysis

The Determination of Free Sulfuric Acid in Light-Oil Sludge. Bacon. (*Swampscott Meeting, A. C. S., Sept.* 1928).

Five methods have been developed for estimating the sulfuric acid in light-oil sludges. (A) The sludge is extracted with water and the sulfuric acid precipitated in the cold with barium chloride strongly acidified with hydrochloric acid. It is uncertain whether the sulfuric esters are hydrolyzed in the operation or not. (B) The sample is weighed on a very thick pad of asbestos in a Gooch crucible. The sludge is washed through with chloroform, leaving the acid sticking to the asbestos to be washed through with hot water and titrated with standard alkali. Such acid as escapes with the chloroform is also titrated and the two figures combined. The method is less accurate than the others, but tests proved that both the mixed and the neutral esters pass through in solution in the chloroform. (C) The sludge and chloroform are thoroughly mixed, and the mixture is emptied into ice-water and titrated. This gives the free sulfuric acid plus one unreplaced hydrogen of the alkyl sulfuric acid. The neutralized solution is boiled 30 minutes or more and again titrated. The result is the equivalent of one replaceable hydrogen set free in the hydrolysis. Subtracting this from the previous figure gives the figure for the free sulfuric acid. (D) The heat of dilution of the sulfuric acid present is measured and the concentration estimated from a curve obtained by plotting against concentration the rise in temperature from diluting acid of various known concentrations to twice the original volume. The results are fairly accurate for high percentages of acid. A correction must be made for the tar present and it is assumed that the specific heat of the tar is 0.5, sp. gr. 0.9, and that the sulfuric acid after dilution is 30 per cent. of the mixture. (E) Aniline sulfate is formed by treating the sludge with 10 per cent. of aniline in boiling chloroform. The precipitate is collected on a Gooch and dissolved in boiling water. The aniline in an aliquot of this filtrate with washings is titrated with half-normal potassium bromide-bromate solution. Careful experiments showed that only aniline sulfate is formed when aniline in boiling chloroform is added to acid sludge and that only the free acid reacts. The table gives an indication of the agreement between the several months:

Method	Sludge	%
A $BaSO_4$ 58.4	50.6	59.5
B Isolation 55.1	49.0	
C Titration 58.6	50.0	
D. Temp. rise.....	...	60.6
E Aniline 58.7	50.4	59.2

Standard Engine for Fuel Tests. (*J. S. A. E., Feb.*, 1929, *p.* 212).

At the February, 1928, meeting of the Co-operative Fuel Research Steering Committee of the American Petroleum Institute, the National Automotive Chamber of Commerce and the Society of Automotive Engineers, a sub-committee on Methods of Measuring Detonation was appointed with T. A. Boyd as chairman. This committee was to devise a means of testing and rating motor fuels as to knocking which could be generally applied. They have had a test engine built after agreeing on certain points needed, such as: that tests should be made in an engine whose cylinder dimensions are similar to those of engines in actual use; that the test engine should be cheap to build and simple to operate; that knocking tests should be made at speeds not over 1000 r.p.m.; and that the mixture ratio used should be that for maximum knock. The cylinder of the engine built has a bore of 3¼ inches and stroke of 4½ inches; a built-in spark-position indicator, a tachometer drive shaft for laboratories which have no dynamometer tachometer, an electric oil heater with three-heat switch, an extension on the front of the crankshaft for attaching an indicator drive, an ignition-breaker drive, an opening into the combustion chamber suitable for indicator connections, a vapor cooling system to maintain a uniform jacket temperature automatically, and a steam-jacketed manifold. The crank-case is made with a flat base on which the engine stands without any other substructure being required. A fixed-compression L-head cylinder or an overhead-valve variable-compression cylinder may be installed. A listening-post indicator is operated by a shaft driven from a dynamometer at one-half engine speed. A cam carried by the shaft raises a ball by means of a plunger once in each revolution of the shaft. At the highest point the ball drops on the diaphragm of a sound box which is connected to one branch of a stethoscope tube. A second sound box is connected with the other branch of the stethoscope tube. The stroke of the plunger can be controlled by a micrometer adjusting dial; so that the intensity of the click of the ball can be matched exactly, in the stethoscope, with the clicks produced in detonation on the diaphragm at the listening post of the engine.

It is the plan of the steering committee to build only 10 of the engines at present. These engines will be used by the sub-committee for series of tests by selected typical methods. If the engine design proves to be fully adapted to the purpose, more engines can be built and a water scheme of co-operative testing put into effect.

NEW PRODUCTS

Voltol. Wolf. (*Petroleum, Jan.* 15, 1929, *p.* 95, *Libr. Bull., U. O. P. Co., Vol.* 4, *No.* 7).

According to Berthelot, de Hemptinne gave special attention to investigating the action of silent electric discharge upon organic compounds. The Olwerken Stern Sonneborn, now known as Rhenania Ossage Mineralolwerke A.-G. Hamburg, commercialized these theoretical studies, making artificial polymerizates on the large scale by the action of the silent electrical discharge upon mineral and fatty oils. Nernst, investigating the principles upon which the process rests, was convinced that hydrogen atoms were split off from the oil molecules by collision with gas ions and the new molecules thus formed were combined into larger molecular complexes. Eichwald and Vogel determined molecular weight and iodine number of olein voltolized in a nitrogen atmosphere. The mean molecular weight increased greatly, the iodine number dropped. Eichwald obtained molecular weights up to 6000 from the benzol solution of the oil.

The technical process is conducted in large closed cylindrical kettles at a vacuum of 60-70 mm. and at about 80° c. (176° F.). The oil to be treated flows over the aluminum electrodes and is thus exposed to the electrical discharge. High-frequency alternating current at about 5000 volts is used and an inert gas, usually hydrogen or nitrogen, prevents oxidation. The viscosity can be raised at will. Voltols with viscosity up to 32° E. at 100° C. are still fluid at ordinary temperatures and have a good cold point. The high viscosities are obtained with no loss of material and the acid number, asphalt content, cold point, and color of the polymerizates remain unchanged; the flash point rises only a little in proportion to the great increase in viscosity. Mineral and fatty oils or mixtures of the two, and low-temperature tar can be treated

Tests of the voltols on power-generating and power-transmitting machines with electric drive, continuous operation, showed power savings of 16.5 per cent. on a 10000 h.-p. triple-stage steam engine, oiling the working parts, fresh oil, drop oiler, an oil saving of 63 per cent. cost saving 25 per cent. on a 6700 h.-p. Voith two-stage Pelton turbine connected with generator, heat from friction reduced 25 per cent.; on a 2700 h.-p. Leobersdorfer two-stage turbine, frictional heat reduced 53.1 per cent.

An advance in lubrication of explosion motors is possible by voltolization, since the same oil will serve in any type of motor and in winter as well as summer. The oiling of explosion cylinders

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Ontario, Port Arthur,
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Ontario, Toronto,
J. H. Morrison
Quebec, Montreal,
Alex. Bremner, Ltd.

Foreign Distributors

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Compagnie Technique Des Petroles
New Zealand, Auckland,
Wilton Furnace & Coal Co., Ltd.

Now . . . More Than Ever!

High Quality Is Essential In High Temperature Cement

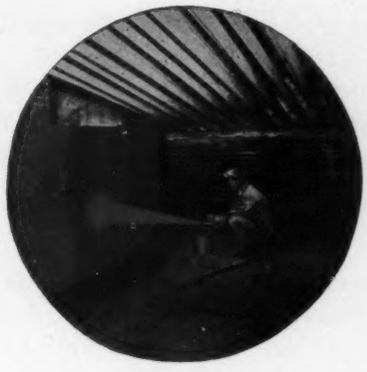
WITH high capacity cracking stills operating at greatly increased temperatures and shorter time between stress periods, still settings require a bonding material that will hold its strength through the entire temperature range, and which will withstand the more rapid heating and cooling of refractories.

Here is no job for ordinary bonding materials. Now, more than ever, high-quality high temperature cement is vitally essential if brickwork is to be long-lived and require only the minimum of maintenance.

Refineries are meeting the new conditions by using:

—ADAMANT Fire Brick Cement—the high-quality, all-temperature cement—for laying up the brick.

—The proper Super-Refractory Mixture of ADAMANT-ADACHROME *Aggregate*, for surface-coatings applied on new and old brickwork by means of The ADAMANT Gun.



Refineries find The ADAMANT Gun (Price only $25.00) a great help in refractories maintenance. They use it for the application of Super-Refractory Surfacings of ADAMANT-ADACHROME *Aggregate*, which fill brick pores and seal the joints, protecting the structure from destructive actions. We'll gladly send suggested mixtures of ADAMANT-ADACHROME *Aggregate* suited to your own conditions. Write us.

Fire brick laid up with ADAMANT Cement have strong, firm joints that remain tight through the entire temperature range. Rapid heating and cooling of the furnace cannot affect the bond of ADAMANT. Brick do not loosen; courses do not creep or travel; walls do not bulge.

Surface-coatings of ADAMANT-ADACHROME *Aggregate* fill up and seal the brick pores and joints, giving the walls a super-refractory coating that retards spalling and disintegration, and protects the structure from destructive actions which cause fluxing or slagging of brick.

ADAMANT Fire Brick Cement comes in 100 lb., 250 lb. and 400 lb. air-tight, metal containers. ADACHROME *Aggregate* is shipped in dry form in 125 lb. paper-lined burlap bags. Stocks are maintained in every refining district. See list of distributors at the left.

To refineries interested in improving refractories service, we shall be glad to send complete data on ADAMANT Cement, and suggested Mixtures of ADAMANT-ADACHROME *Aggregate* suited to your own individual conditions. Write us.

Botfield Refractories Co.

World's Largest Exclusive Manufacturer of High Temperature Cement

Swanson and Clymer Streets, Philadelphia. Pa.

For a Long Furnace Run, Use The ADAMANT *Gun*

ADAMANT
FIRE BRICK CEMENT

Whenever You Use a Fire Brick, Use ADAMANT, *the Original High Temperature Cement*

makes greater demands upon a lubricant than does bearing lubrication on account of the high temperatures obtaining in the cylinders; and a motor lubricating oil must burn as nearly without residue as possible. Even during the war voltol oil proved itself an excellent substitute for castor oil in aeropline lubrication.

Cylinder oils emulsified with water are not only protected against vaporizing and decomposition but are atomized in the cylinder. At first lime water was used as the emulsifying agent, so that the emulsion consisted of three components. But voltol cylinder oils form a stable emulsion with water alone which is a means of rational cylinder lubrication.

* * *

A series of medium-grade lubricants, viscosity 320 seconds at 38° C., gave a maximum difference of 12 seconds at 98° C., of 27 seconds of 54.4° C., and corresponding differences in results on the frictional bearing.

SAFETY AWARD

Flying the banner of "No Accidents in 1928," the Mine Safety Appliances Company, Pittsburgh, an institution dedicated to the safety movement, has just been given the Rice Safety Award by the Western Pennsylvania division of the National Safety Council, emblematic of the best accident prevention record in the Pittsburgh area last year.

This company, which employs 503 men and women had but 34 days of lost-time accidents and no fatalities or permanent disability cases in 1928. The award was doubly significant because of the fact that the safety competition was especially keen in the great manufacturing section of Western Pennsylvania and furthermore, by reason of the fact that employees of the Mine safety Appliances Company in developing protective, detective and resuscitating equipment for poisonous and explosive gases are exposed to unusually hazardous conditions during the course of a year's time.

The motto "Practice What You Preach" was never better illustrated than in the case of the award which has just been made.

The P. H. & F. M. Roots Company, Connersville, Indiana, has just issued a new 16-page bulletin, Number 22-B-1, on low pressure type rotary positive blowers. The bulletin covers the new Roots modernized blowers equipped with Timken SKF and Hyatt Bearings. A dimension print, table of sizes giving speed, capacities and horsepowers at various pressures, and a brief review of various types of pumping units are included in this new bulletin. Bulletin 22-B-1 replaces the former bulletin 1011 issued by this company, and is so constructed to make it a valuable addition to the large Roots catalog covering pumps, meters and blowers.

Attractive Dividends Result

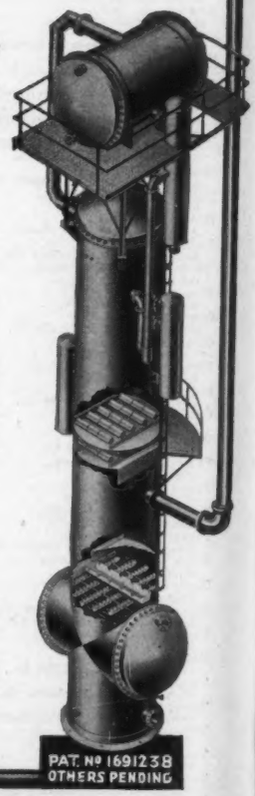
from replacing obsolete equipment with modern

ERECO Equipment

How long since you made a thorough survey of your plant's efficiency?

Check your present recoveries, operating costs and other factors and compare them with the guaranteed performance of ERECO Equipment.

Our competent engineering staff will be glad to show you how ERECO Equipment may successfully be adapted to your individual needs.



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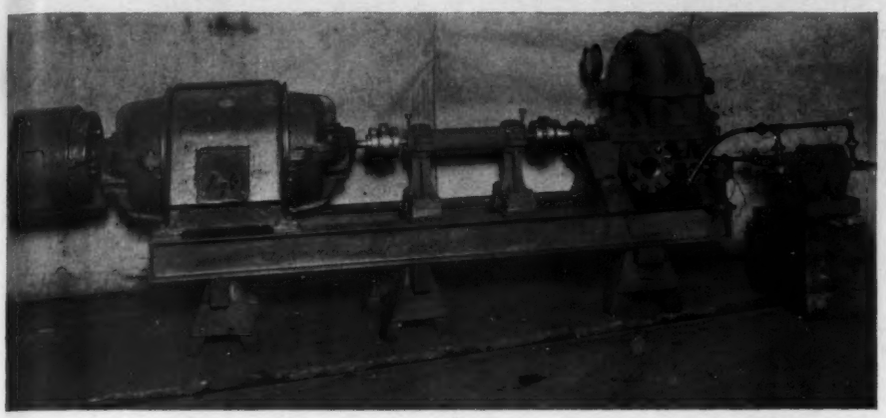
ALLOYS • LUBRICATORS • CHEMICAL PUMPS • TANK CAR VALVES

NEW EQUIPMENT, CATALOGS, BULLETINS, BOOKS



Worthington Cold Oil Pump

New Cold Oil Pump
WORTHINGTON PUMP AND MACHINERY CORP.

An interesting development in the cold oil pump field is the application of the Worthington centrifugal oil line pump in small sizes to refinery practice. The use of the loop design to obtain a more gradual conversion of velocity to pressure and the use of wider smaller impellers designed for oil had shown extremely high efficiencies. The elimination of one stuffing box, the use of fewer stages, and an internal bearing and balance disc had resulted in the simplest and most reliable type of pump.

Fire insurance requirements made it necessary to use a fire wall extension. The idler shaft with two ball bearing pedestal supports made an ideal arrangement. The use of pedestal bearings assures the alignment of the unit independent of the wall.

Another outstanding feature is the use of the structural steel baseplate. This base is rigid and strong and permits perfect alignment of pump idler shaft and driver. It also forms a more perfect part of the fire wall, and does not sacrifice anything in appearance to obtain this result.

Oil Separator
GRISCOM-RUSSELL COMPANY

The Griscom-Russell Company has recently published a leaflet describing the Bundy oil separator for removing oil from exhaust steam and gasoline from compressed natural or casinghead gas.

An interesting feature of this separator is the special grid arrangement in staggered position on multiple plates. Through this arrangement the liquid particles being carried along with the vapor are caught by the grids on the second plate if they pass between the grids of the first plate. After being caught by the grids, the particles of oil or gasoline immediately are removed from the vapor path by dropping into an interior channel cut through the center of each column of grids so as to conduct the oil into the receiving chamber.

The new bulletin describes the construction and application of these separators, with special reference to its uses and advantages for refinery work, and includes a complete table of the arrangements, sizes and dimensions in which they are furnished.

Copies may be obtained by writing to the Griscom-Russell Company, 285 Madison Avenue, New York.

Filter
GOSLIN-BIRMINGHAM MANUFACTURING COMPANY

Goslin-Birmingham Manufacturing Company's Vallez filter for dewaxing and contact filteration is dumped by the use of valves and not opened up to have cake removed. It is designed to eliminate loss of volatiles, and to avoid the necessity for gas masks for workmen in the house. A new feature is the means of reducing refrigeration because the filter can be insulted.

This filter, illustrated here, consists of a series of disc-shaped filter "leaves" mounted on a hollow shaft inclosed in a cylindrical cast iron vessel or "shell." The leaves are hollow and covered with filter cloth. The material to be filtered is pumped into the filter shell under pressure, and the leaves and shaft revolve slowly as the liquid is being filtered through them. Each leaf filters as a unit, discharging the filtrate into the shaft, which serves as a common header for carrying the filtrate out of the shell.

The filter shell is a cylinder, divided on the horizontal center line into two halves. Inspection doors are located on one side of the upper half, and on the top is placed a spray pipe used for removing the cakes from the leaves. The sprays are so located that each leaf revolves between two of them, so that the whole surface of the leaf comes in contact with their action.

The bottom of the lower half is shaped like a trough. When the filter is used to remove solids from solutions which form a heavy cake, this trough contains a right and left hand screw conveyor which discharges the cake through a door situated in the middle of the room.

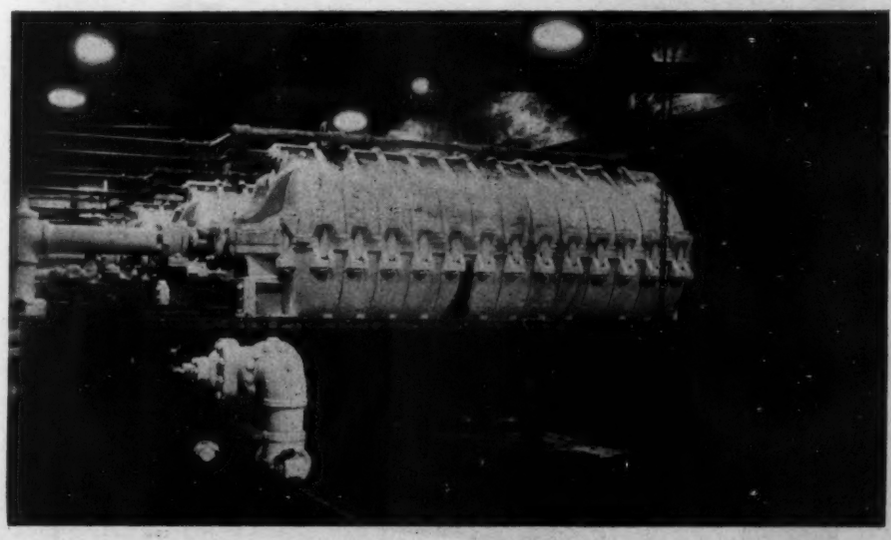
When the filter is used for clarification with a filter-aid, this screw conveyor is replaced by a perforated pipe which is used for agitating and disintegrating the filter mat before it is drained from the filter.

The manufacturers and distributors, with headquarters at Birmingham, Alabama, will furnish more details of the Vallez filters upon request.

Electric Saw
BLACK & DECKER MANUFACTURING COMPANY

Black & Decker Manufacturing Company, Towson, Maryland, has announced a new electric saw in six, eight and 10-inch sizes as an added line to its portable electric tools.

The saws are designed to cross-cut and rip lumber up to 3½ inches thick,



Goslin-Birmingham Filter

TUBE TURNS

A NEW AND EXCLUSIVE PROCESS
FITTING FOR WELDED PIPING

No thinning of outside wall or buckling of inside wall. Greater strength, less friction, longer life.

Wide Applications

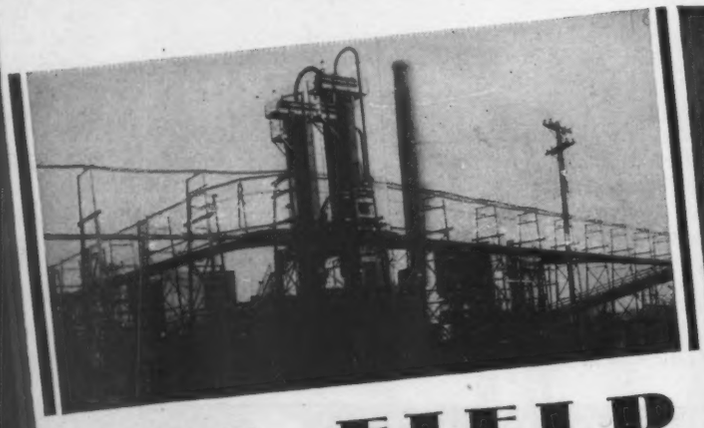
Used to provide any kind of elbow, off-set, branch, or return bend in welded piping. To replace cast fittings and mitre-welded elbows, or wherever a tight, flexible, safe, SEAMLESS drawn fitting of low friction resistance will improve the installation.

Immediate delivery of standard sizes from either our own warehouse, or from stocks at Louisville, Ky. Price lists and descriptive bulletins mailed on request.

Maintenance Engineering Corporation

1400 Conti St. **Phone Preston 2274-5**

Houston, Texas



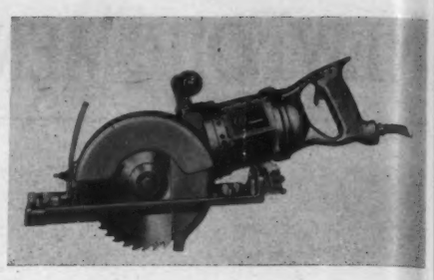
OIL FIELD PIPING

For years this company has helped the most prominent oil field concerns to meet individual piping problems effectively and economically. *Put your piping problems up to Power Piping Co., Pittsburgh, Pa.*

Power Piping

FOR EVERY OIL FIELD NEED

189



Electric Hand Saw

and can be used with a special metal cutting saw for cutting light gauge metal or with an abrasive disc for cutting slate, marble, tile or porcelain.

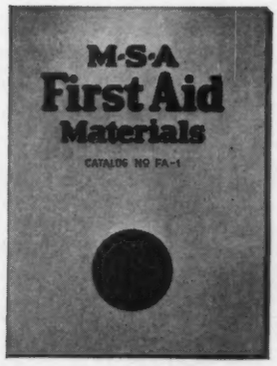
The blades are enclosed in telescopic guards which, when the cut is finished, automatically snap back, covering the saw blade. The saw is equipped with an adjustable shoe which can be set for cutting at any depth up to the capacity of the saw. The shoe is also adjustable for cutting at any angle up to 45 degrees for mitering or for the jointing of long edges.

It is provided with Universal motors which operate on direct or alternating current, and are shipped in substantial carrying cases for portability.

A "pistol grip and trigger switch" afford ease in handling and controlling. The tools are ball-bearing with chrome nickel gears and shafts. They are air cooled and operate continuously without overheating. Gears run in grease and in a grease-tight compartment.

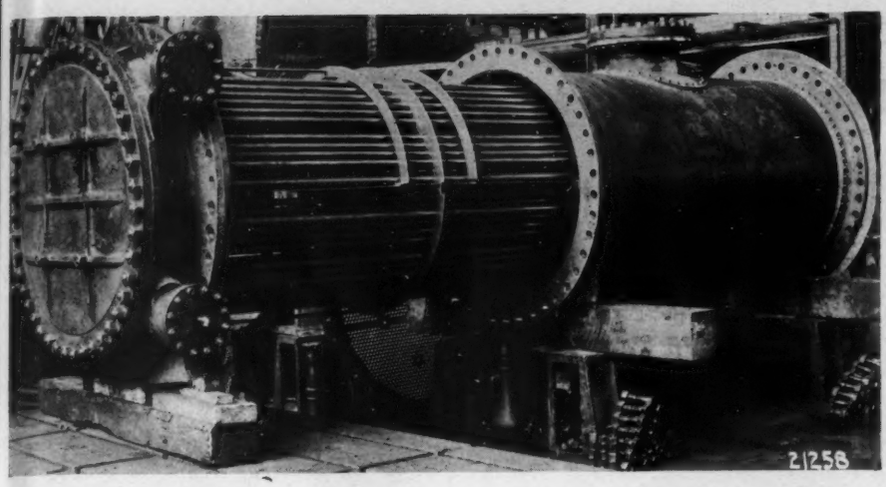
Details on this new equipment may be had by addressing the company direct.

Catalogue
MINE SAFETY APPLIANCES COMPANY



Catolg No. FA-1 of the Mine Safety Appliances Company, Braddock, Thomas and Meade Streets, Pittsburgh, 32 pages in length, is the latest outlay of equipment manufactured and distributed by this company. A copy of this catalog, which is illustrated here, will be mailed upon request.

Illustrations of the safety appliances and first aid materials manufactured by the company are fully given in Catalog FA-1, along with detailed descriptions of individual articles. Complete tables on prices are also contained. An important feature of this display of equipment is the photographic demonstration of uses of different equipment.



Westinghouse Condenser, showing the tube bundle partly withdrawn

Heat Exchangers

WESTINGHOUSE ELECTRIC AND MANUFACTURING CO.

The line of heat exchangers of Westinghouse Electric and Manufacturing Company, which has recently gone into the heat exchanger field actively include coolers, fractional condensers and final condensers for low and high pressure service. These vary in size from very small units to those containing several thousand square feet of surface. All apparatus is designed especially to meet the specific conditions of each installation. In order to secure greater flexibility, Westinghouse heat exchangers are usually furnished in multiple units and installed in battery arrangement. By means of by-pass valves one or more units can be cut out of service for inspection or cleaning without necessitating a total shut down of the still or loss of exchanger capacity. The battery arrangement also permits heat exchanger capacity to be transferred from one still to another without removing the old apparatus, wherever additional units are installed.

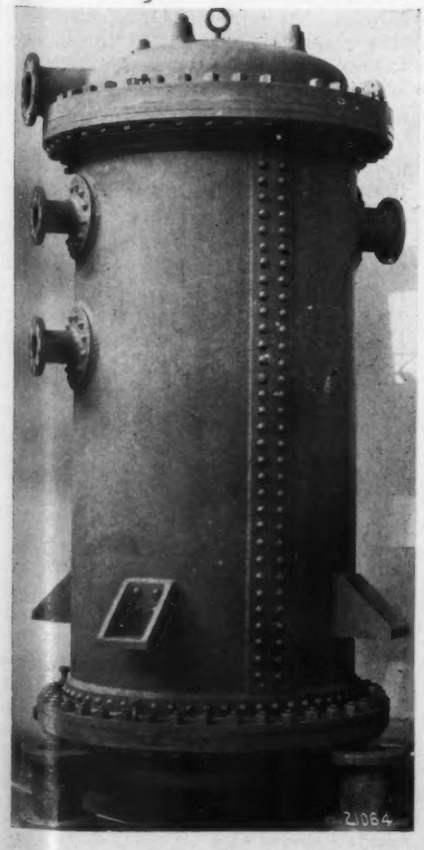
Specifications for Westinghouse heat exchangers include shells made of rolled steel plate, or of hammered welded steel. Cast iron shells are used for applications where steel is not suitable because not sufficiently resistant to corrosion.

The end flanges are made of forged steel, riveted and electric caulk-welded to the shell. All heads are made of either close grained cast iron or cast steel depending upon the operating conditions encountered. Tubes of any length required are furnished of either seamless drawn steel or seamless drawn admiralty metal unless operating conditions are such that tubes of special alloy are required.

Tube plates are furnished of rolled steel, naval brass or of any special alloy required to meet operating requirements.

The gas and condensate cooler of special design. It functions as a final condenser for still gases and as a cooler for condensate, and is located between the regular condensers and the absorption equipment that treats the still gases. Water, colder than that used in the regular condensers, is circulated through the cooler for further recovery of light fractions.

A view is also given here of a partial condenser for atmospheric bubble tower work, showing the tube bundle partly withdrawn. The floating tube sheet and reverse liquid channel are carried on rails that are welded to each side of the shell at the horizontal center-line. By so locating the rails, binding is prevented while withdrawing the tube bundle. A horizontal baffle rests on the rails, forming a seal which gives a maximum degree of effectiveness to the baffle.



Westinghouse gas and condensate cooler

The Worthington Pump and Machinery Corporation has recently announced the taking of a license from the Dow Pump and Diesel Engine Company of Alameda, California, used in connection with refining, under the Thompson Patent No. 1250050.

Return Bend

STOCKHAM PIPE AND FITTING COMPANY

The new Stockham Frantz-type return bend was designed to save power, to reduce time off stream for replacement of cleaning of tubes, and to increase the safety factor. Reference to the accompanying illustration shows the simplicity of assembly and ease of tube installation.

Tubes are inserted through the tube sheets. The yoke is placed over a pair of tubes; the split rings are placed in the yoke, which, with the rings, are slid back against the up-set ends of the tubes; the U piece is placed over the tube ends and a tight joint is made by means of the toggle and lock screws.

Tube ends in this assembly are up-set or rolled in the fabricating shop or at the mill rather than being rolled in cold.

The yoke is in one piece with ample strength to hold the U piece and tube ends together, while no excess weight must be rolled into the yoke where it must support tubes and withstand corrosion. Since the yoke, toggles and lock screws are not in contact with the corrosive oils, these parts need not be replaced when changing tubes or U pieces; they are subject only to ordinary wear and tear.

The U piece is designed to reduce friction to a minimum because of unobstructed smooth flow with minimum pressure loss. The U piece is the only part of the assembly in contact with the corrosive elements in the charging stock, and is

Stockham Fantz-type Return Bend

For cracking process in oil refineries we furnish Aluminum Armored Asbestos filled Gaskets and Corrugated Armco Iron or Monel Metal Asbestos encased.

Copper rings 3/16" thick for 4 and 5" O. D. tubing.

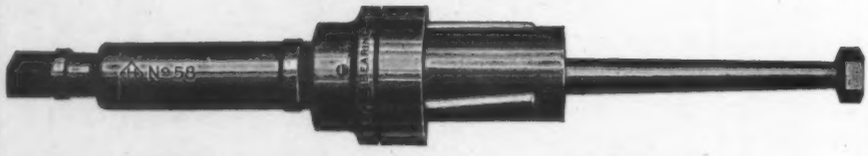
Washers or gaskets made of Aluminum, Copper and other Metals.

Write for Prices.

METALLO GASKET CO.

NEW BRUNSWICK, N. J.

Heavy Duty Expanders for Still Tubes



Tools for the Oil Industries

Hydraulic Pressure Pumps, 8000 pounds
Tube Expanders for Cracking Still Tubes
Hydraulic Pressure Pumps, 2000 pounds.
Tube Expanders for Condenser Tubes
Hydraulic Pressure Pumps, 500 pounds.
Tube Expanders for Steam Boilers
Screw Punches for Structural Shapes
Tube Expanders for Pipe Work
Screw Punches for Plate Work
Flaring Tools for Still Tubes
Beading Tools for Still Tubes
Hydraulic Jacks
Hydraulic Punches

A. L. HENDERER'S SONS

Wilmington, Del.

Established 1870
Expanders since 1884

easily replaced at little expense. There are no plugs nor deflector pieces to cause coking troubles or freezing.

The Stockham Frantz-type return bend is manufactured to meet any specifications for pressure, temperature, tube diameter and tube spacing. Patents have been applied for in the United States and principal foreign countries.

Lincoln Safety Starter

Safety Starter

LINCOLN ELECTRIC COMPANY

An improved starter which starts a motor directly across the line has been recently placed on the market by The Lincoln Electric Company, Cleveland. The starter is controlled by the new Lincoln safety push button, which is standard equipment with the "across the line" safety starter.

Ease of installation, accessibility to all operating parts and rugged consruction are some of the advantages offered in the new starter.

Installation of the starter is simple, and only four screws are required to hold the starter in place. Releasing two other screws permits the contractor panel to swing out, thus making lead contacts easily accessible. A cover of the drop hinge type encloses the entire mechanism and permits installation of starters closely grouped, two inches clearance between starter boxes being ample for easy eccessibility.

Long life is given contact points by the wiping action, which prevents pitting and by the cadmium plated steel shields which provide an instantaneous thermal and magnetic quench for the arcs. Arc chimneys are of heavy pressed magnesite which shield against currents far higher than any to which the starter will ever be subjected. The relay armature has a cushion action for reducing wear and insures long life. Likewise it is provided with replaceable bronze bearings and is actuated by a coiled spring.

The Lincoln Safety Push Button pro-

vides an additional safety factor to the Lincoln "across the line" safety starter in that the red stop button encircles and protects the green start button so that it is impossible to close the starting circuit unintentionally. The safety push button can be mounted on the side of the starter box or arranged for remote control.

Catalogue
LUDLUM STEEL COMPANY

Ludlum Steel Company of Watervliet, New York, has published a 32-page catalog covering Nitralloy and the Nitriding process. The following table of contents make up this catalog:

Nitralloy and Nitriding Process, The Analyses of Nitralloy, The Physical Properties of Nitralloy, The Operations Prior to Nitriding, The Equipment for Nitriding, The Nitriding Process, The Operations after Nitriding, and The Properties of the Nitrided Case. Diagrams and charts illustrate the above articles for completeness, and photographs of equipment resulting from the processing are used for examples of the operations.

A copy will be mailed upon request to Ludlum Steel Company.

Air Heater Bulletin
SHAW-PERKINS MANUFACTURING COMPANY

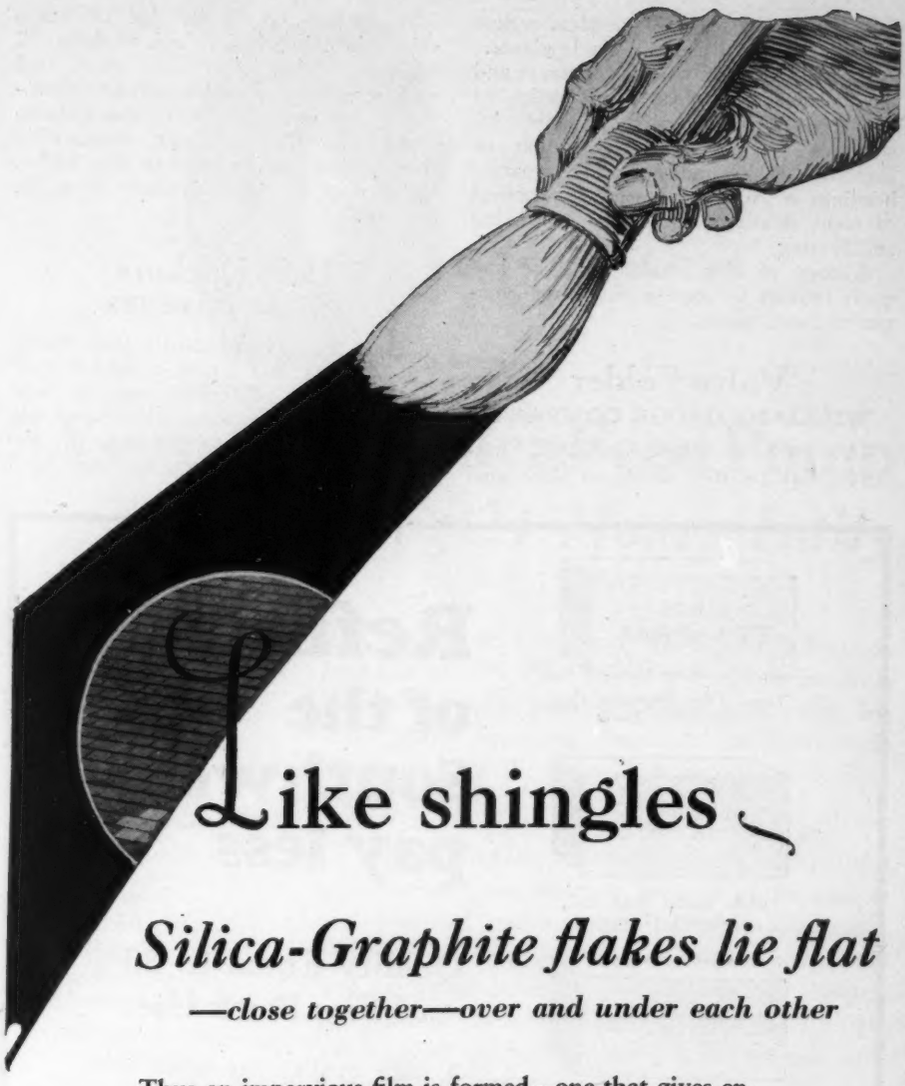
Shaw-Perkins Manufacturing Company, Oliver Building, Pittsburgh, has published a four-page folder describing its air heaters for recovering heat ordinarily lost in boiler stack gases and returning this heat to the furnace as preheated combustion air. The saving in fuel cost to result is outlined, as is the accomplishing of a further gain in the reduction of unburned carbon in the ash, an increase in carbon dioxide, and a general improvement in furnace conditions. Heaters for drying and for process operations are also described in this bulletin.

A copy of this bulletin may be secured by writing Paxson Winsborough, vice-president of the company, at the above address.

Enduro Nirosta Steel Catalogue

Enduro Nirosta Steel products, produced under Krupp-Nirosta patents and under the supervisory direction of Professor Doctor Benno Strauss, director of research, Fried Krupp A. G. Germany, by the Central Alloy Steel Corporation, Massillon, Ohio; Ludlum Steel Company, Watervliet, New York; and the Babcock & Wilcox Tube Company of New York are given a neat display through a catalog just off the press. Announcement is made in this catalog of Enduro K-A-2 steel being made available to American industry through American enterprise.

For the purpose of illustrating this new product the catalog pages are faced with Enduro K-A-2. The various uses of the product are briefly told throughout the catalog and illustrated on the opposite



Like shingles

Silica-Graphite flakes lie flat

—close together—over and under each other

Thus an impervious film is formed—one that gives entire protection to every inch of surface under it.

The pigment used in *Dixon's Silica-Graphite Paint* is flake graphite which is combined by nature with silica. The vehicle is boiled linseed oil. Every experienced paint maker knows that this combination provides the most satisfactory paint protection. Every user of *Dixon's Silica-Graphite Paint* knows this paint lowers their yearly painting costs by tenaciously clinging to and protecting surfaces to which it is applied in spite of moisture fumes, and other destructive conditions found in and about industrial plants.

You'll be interested in our booklet 99-B. It tells the full story of this remarkable protective paint.

JOSEPH DIXON CRUCIBLE COMPANY

JERSEY CITY D X N NEW JERSEY

Established 1827

DIXON'S SILICA GRAPHITE PAINT

Adequate Protection at Minimum Ultimate Cost

page, giving the reader a complete outline of each industrial use at a single glance.

Tables showing corrosion resistance and the chemical and physical properties of the product are given in a simply instructive manner. The fabrication of Enduro K-A-2 is outlined under separate headings of forging, annealing, removal of scale, riveting, welding, and soldering and brazing.

A copy of this catalog may be had upon request to any of the three companies listed above.

Valve Folder

WILLIAMS GAUGE COMPANY

The Williams Gauge Company, Pittsburgh, has recently issued an illustrated folder which covers its line of pump valves, including boiler feed, washout, fill up, vacuum, hot water, cold water, fuel oil and gasoline. Construction and operation of the new pump valve seat as compared with the old, with comparative photographs, are featured in this folder, which may be obtained direct from the company.

Belt Slackers

HARRY M. PERRY

Harry M. Perry, 638 North Main Street, Los Angeles, has issued a folder sheet describing the different lines of belt-slackers which he manufactures and distributes. The three applications of the very successful Cantilever-spring belt-slacker are illustrated in photographs and drawings in detail. Full information covering this line of belt adjusters, which are built to fit any motor, may be had by writing Mr. Perry at the above address.

Enduro Tubes

Babcock & Wilcox Tube Company has published a neatly bound 24-page bulletin covering completely Enduro KA2 Seamless tubes and pipe.

Enduro KA2, which is one of the several alloys manufactured under the general name of "Enduro" by the Central Alloy Steel Corporation, is described in the introduction to the bulletin as being produced under Krupp Nirosta patents and under the supervisory direction of Professor Doctor Benno Strauss, director of research for Krupp A. G. Essen, Germany. The methods of processing "Enduro" are fully outlined.

Tables, including complete analysis on chemical, physical and other properties of "Enduro," oxidation resistance of the product, corrosion resistance of "Enduro," theoretical weight—pounds per foot—weights and dimensions of seamless "Enduro" pipe, and maximum lengths in feet, seamless enduro tubing with thickness of B. W. gauge, are published in this bulletin.

Stories on "Embrittlement at High Temperatures" and "Design of Tubes for High Temperatures" are fully illustrated with curve charts, and other stories on "Working Qualities" and "The Manufacture of Seamless Tubes and Pipe" are carried in detail. A page is devoted in the bulletin to trade customs of Babcock & Wilcox, manufacturers and distributors.

Copies of this bulletin may be obtained by writing Babcock & Wilcox Tube Company, general sales office, 85 Liberty Street, New York City. Twenty-three branch offices are maintained by the company in the United States, Cuba, Porto Rico and Hawaii.

New Book on Testing Petroleum

"Standard Methods of Testing Petroleum and Its Products" in its second edition, 1929, contains many important revisions and new methods. This book, which may be obtained from The Institution of Petroleum Technologists, Aldine House, Bedford Street, Strand, London, W.C.2, for seven shillings, six pence net, has 137 pages, plus a complete index, and carries 30 illustrations.

It is virtually the report of the standardization committee of the Institution of Petroleum Technologists, and gives standard methods for testing the following: gasoline, benzol mixtures, whit spirit (turpentine substitute) kerosene, long-time burning oil, gas oil, mineral lubricating oils, transformer and switch oils, fuel oils, asphaltic bitumens and asphaltites, commercial paraffin scale and refined paraffin wax, and crude petroleum, with specifications of apparatus, etc., regarding sampling.

Texas Clay Products Co.,
Malakoff, Texas

Elgin Butler Brick Co.,
Austin, Texas

Acme Brick Company
Ft. Worth, Texas

Athens Brick & Tile Co.,
Athens, Texas

Refiners of the Southwest pay less

Quality Equal to 85% of Fire Brick Uses

A high quality fire brick with a low, local freight rate! That's why Refiners of the Southwest use Texas Fire Brick. Get the grade you require at the price you desire, use

TEXAS FIRE BRICK

[**Other Economies:** We often find customers using higher grade brick than is needed. Tell us your needs; it may be we can effect still greater economy for you.]

Write Any Member Listed

Texas Fire Brick Mfgrs. Assn.

Promoting Texas Fire Brick Economies

A a recent meeting of the board, Thos. W. Stone was elected a vice president of the Western Gas Construction Company of Fort Wayne, Indiana.

Mr. Stone graduated from the Ohio State University in the class of 1902, *entered the employ of the Western Gas Construction Company in June of the same year, and has served during the ensuing 27years in the capacity of draftsman, superintendent of erection, assistant engineer and chief engineer.*

The Land Supply Company, Oklahoma City, which has been a distributor of A. Y. McDonald Manufacturing Company, Dubuque, Iowa, products, has just opened a supply store in Tulsa, at 307 East Third Street. With this expansion the oil handling equipment of A. Y. McDonald Company will be available for immediate delivery to Tulsa customers. The Oklahoma City store of the Land Supply Company is located at 516 North Broadway.

S. C. Miller Becomes District Manager

S. C. Miller, a member of the Elliott Company, Jeannette, Pennsylvania, for two years, has been named district manager with offices in Denver for Elliott Company and Associates. Offices have been established at 1101 Security Building. Mechanical and shop experience was obtained by Mr. Miller in Scotland and India, and sales experience has been gained through the Elliott Company's Chicago office.

Central Iron Offices

Central Iron & Steel Company has recently announced changes in its New York and Pittsburgh offices. The New York district office, formerly in Suite 1506-1507 Evening Post Building, is now located in Suite 516 in the new Cunard Building, 25 Broadway. The Pittsburgh district office has been changed from 1606 Commonwealth Building ta 1721 Oliver Building.

The metal bars of "V" Pilot Packing are still intact after three years of service on a boiler feed pump, operating at 200 lb. pressure and 200 to 215°F.

3 Years On a Boiler Feed Pump *Operating 24 Hours Daily*

A TYPICAL example of the dependability and long-life of "V" Pilot Packing is shown in these rings which have packed a boiler feed pump for three years, operating practically 24 hours each day, under 200 lb. pressure, at temperatures from 200 to 215° F.

"V" Pilot Packing serves longer on practically every refinery application because of its unique and patented construction. Its continuous, solid "V"-shaped bar gives a metallic face which offers less frictional resistance on the rod or plunger. Its resilient asbestos back compensates for the vibration of the rod, providing a perfect seal with minimum friction.

Even if the service you now obtain from packing is considered satisfactory, you will welcome the longer packing life and fewer replacements that "V" Pilot provides. Give "V" Pilot a trial — as a test, on your steam glands — and see how it stands up.

Distributors

BEAUMONT, TEXAS
Norvell-Wilder Hardware Co.

BUFFALO, NEW YORK
Buffalo Mill Supply Co.

CHICAGO, ILLINOIS
O. C. Keckley Company

DENVER, COLORADO
The Mine & Smelter Supply Company

FORT WORTH, TEXAS
Norvell-Wilder Hardware Co.

HOUSTON, TEXAS
Texas Rubber Specialty Co.

LOUISVILLE, KY.
Graft-Pelle Co.

PITTSBURGH, PA.
Argo Asbestos & Rubber Co.

ST. LOUIS, MISSOURI
J. P. Bushnell Packing & Supply Company

SHREVEPORT, LA.
Norvell-Wilder Hardware Co.

TOLEDO, OHIO
Hardy & Dischinger

TULSA, OKLAHOMA
Mid-Continent Sales Service Company

The nearest distributor of "V" Pilot will gladly arrange for your trial. Or, if you prefer, write us direct.

New Jersey Asbestos Company

One Water Street, New York, N. Y.

Philadelphia
216 Walnut St.

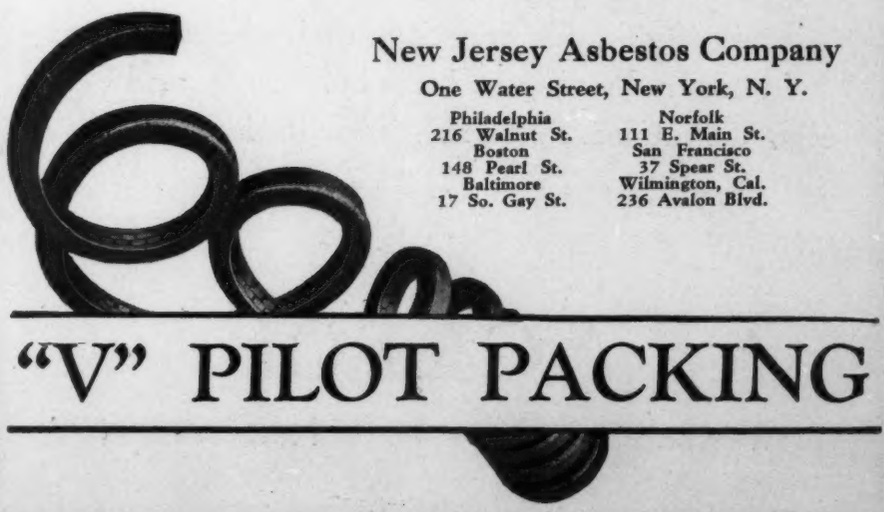
Boston
148 Pearl St.

Baltimore
17 So. Gay St.

Norfolk
111 E. Main St.

San Francisco
37 Spear St.

Wilmington, Cal.
236 Avalon Blvd.



Welding Monel Metal

Success in welding Monel metal requires a knowledge of the properties of this alloy and of its peculiarities under the welding flame.

Monel metal is an alloy of nickel and copper containing about 67 per cent. nickel, 28 per cent. copper, with five per cent of other elements such as iron, manganese, silicon and carbon. In appearance Monel metal when new resembles untarnished nickel. Probably the most valuable property of Monel metal is its resistance to corrosion.

In welding Monel metal a few simple precautions must be observed. First, a neutral flame should be used. The tip should be one or two sizes larger than would be required for steel of the same thickness. Cold drawn Monel metal wire or strips cut from sheet, should be used as welding rod. As a general rule, flux is not required. The oxide film that forms on the surface of the puddle helps to protect the metal underneath from further oxidation. Keeping the outer envelope of the flame spread over the weld area will also aid in excluding air. The rod should be melted under this skin of oxide and slag. Any particles of dirt or foreign matter should be worked up into the slag by melting underneath them. Then, when the weld is built up well above the surface, as all Monel metal welds should be, grinding will remove all oxide, slag and impurities, leaving only good sound metal in the weld.

Welded Monel Header Used in Chemical Plant

Monel metal castings present a peculiar combination of properties. Like gray cast iron, they are sensitive to sudden temperature changes while under the welding flame. Consequently in welding such castings they must be carefully preheated, welded while hot and allowed to cool very slowly. Like cast aluminum, Monel castings have very little strength when hot so the piece must be properly supported in the preheating furnace in order that the various parts of the casting do not collapse or distort under their own weight. The casting should be brought to an even dull red heat of about 1200 degrees and the temperature maintained as steady as possible during the welding.

When the weld is completed cover all openings of the preheating furnace with asbestos paper, close the draught holes with sand and allow the casting to cool gradually in the dying fire. Do not uncover until the casting is stone cold. It is most important that the annealing process be carefully carried out as success depends largely upon this factor.

The Edeleanu Process

Refine your distillates with liq. SO_2 and avoid

Inferior finished products

Treating losses

Acid sludge production

Loss of Treating Agent (SO_2)

Loss of valuable constituents in the distillates

In use by leading refiners in U. S. A. and Foreign Countries. For full information write

AGEFCI

11 W. 42nd St New York, N. Y.

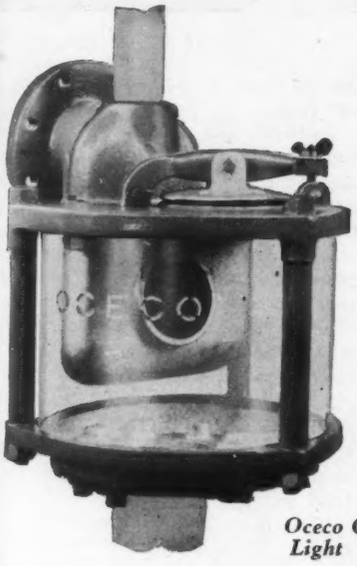
New Sales Office For Griscom-Russel

Griscom-Russell Company has established a new sales office at the Lewis Building, Portland, Oregon, to handle its Reilly and Bentube Evaporators for producing distilled water for boiler feed make-up, U-Fin Generator Air Coolers to cool the air from generator windings, Multiwhirl Oil Coolers for cooling the oil from turbine bearings, reduction gears, transformers or heat treating pocesses, Bleeder Heaters for using the steam bled from turbine stages to preheat the boiler feed, Expansion Joints for low pressure steam lines, and Condensers, Coolers and Heat Exchangers for petroleum refining and chemical process work.

Mitchell-McDaniels and associates have erected a single still 250 barrel daily capacity skimming plant in the shallow oil field located nortn of Putman, Callahan County, and are purchasing crude from nearby shallow leases at a premium of 25 cents per barrel above the posted price. The output of the plant is being marketed in trucks. The plant is made up mostly of second-hand equipment.

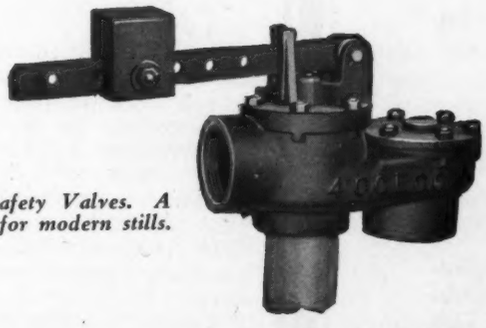
Wherever Oil is Refined.....

Oceco 2-Bolt Couplings, for coolers, coils, pipe lines.



Oceco Cylindrical Look Boxes. Light enters from all sides.

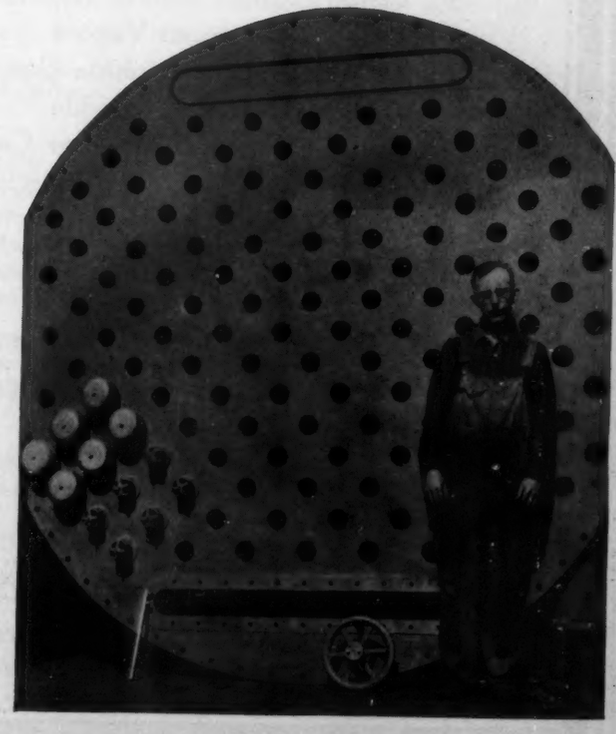
THERE'S a big saving in using these dependable Oceco Fittings—for receiving house, stills, refinery yard. May we send you the proof?



Oceco Still Safety Valves. A modern valve for modern stills.

Oceco Bubble Trays from one piece castings.

Oceco One-man Bell Caps (in iron or aluminum).



Also—

Automatic Tar Plugs, which automatically shut in case of fire.

The Oil Conservation Engineering Company

877 Addison Road **Cleveland, Ohio**

Engineering and Sales Service:

25 Broadway, New York — Tulsa Trust Bldg., Tulsa, Okla.

Box 552, Beaumont, Texas — Neilan, Schumacher & Co., Los Angeles, Cal.

Canfield Boiler Plant

Canfield Oil Company has completed a new boiler plant at its Coraopolis, Pennsylvania, refinery and switched the steam load from the old to the new plant without interrupting production.

The refinery has a coal silo of 300 tons capacity which takes coal direct from the hopper bottom cars with a feeder and elevator hook-up for boiler fuel. A weigh larry of 1000 tons capacity extends along the firing aisle in front of the boilers, and coal is handled direct from the silo to the weigh larry.

The refinery maintains a 1000 boiler horsepower steam load. Three 350-horsepower boilers have been installed, two of which will operate at 150 per cent. rating and the third will be used as an extra. The extra equipment is necessary with a uniform load of 24 hours daily and a seven-day week load.

The boilers are longitudinal drum, water tube type with vertical baffles, and a single retort underfeed stokers with forced draft equipment. The boilers are fitted with superheaters, designed for 100 degrees superheat when operating at 175 per cent. rating.

A reinforced concrete chimney 175 feet high is adjacent to the boiler house. The steam generated is used for process steam throughout the refinery, so that it is not feasible to return the condensation to the boiler house; hence

Canfield Power House

the make-up water for this plant is 100 per cent.

Canfield Oil Company has its own water supply system from deep wells located on the property. This water is not suitable for boiler work unless treated, and a "Zeolite" water softener is used for treating. Water is pumped through the softener to an overhead storage tank and from the storage tank flows by gravity to a deaerating type water heater. From the feed water heater the water flows by gravity to two boiler feed pumps. These pumps feed the water directly to the boilers through water line governors and an excess pressure governor on the boiler feed pumps.

The forced draft equipment for the boilers consists of two turbine driven forced draft mains discharging into an underground duct system to the stokers.

Boilers are fitted with suitable soot blowers. Main boiler dampers and forced draft turbines are controlled automatically by a modern type of damper control. Each boiler is fitted with instruments indicating the steam flow from each, the air flow, temperature of the flue gas and three-point draft indicator, indicating wind box pressure, furnace draft and up-take draft.

The boiler house building is a steel and brick structure with steel sash and cement tile roof. All materials are non-combustible. Steel building columns are utilized for the front supports of all three boilers. This plant is now carrying the entire load.

Boiler Inventor Dies

H. S. Bradley, president of the Lagonda Manufacturing Company, which he has headed for 31 years, died at the age of 76 in Springfield, Ohio, May 15, following a year of bad health. Bradley designed and manufactured the boiler tube cleaner after organizing his company in 1898, about the time the water tube boiler was coming into common use. Prior to organizing his own company he served the Foos Manufacturing Company as secretary for 16 years.

THE H-H INHALATOR

A Valuable Resuscitation Device for the Oil and Gas Industries

The H-H Inhalator is a resuscitation device for administering Carbogen (95% of Oxygen and 5% Carbon Dioxide) to those overcome by

Petroleum Vapors
Hydrogen Sulphide Gas
Carbon Monoxide
Smoke, Fumes and Other Causes

When respiration has stopped, artificial respiration by the manual prone pressure method should be employed to start spontaneous breathing. This effort should be assisted by administering Carbogen simultaneously from the H-H Inhalator.

The H-H Inhalator is officially approved by the American Gas Association and is widely used by oil companies at refineries, in the field and on tank ships.

For complete information write for Bulletin No. 80. Demonstrations will be given on request.

Mine Safety Appliances Co.

Braddock, Thomas and Meade, Pittsburgh, Pa.

"Everything for Mine and Industrial Safety"

Amtorg Contracts For Large Order

An agreement has just been concluded between the Amtorg Trading Corporation and the Foster-Wheeler Corporation of New York providing for the supply of large quantities of oil refining equipment manufactured by the American company to the Azneft and Grozneft, the principal oil producing organizations in the Soviet Union. The contract provides also for technical consultation and assistance by the Foster-Wheeler Corporation. The first orders on this agreement, which are now being placed, amount to approximately $2,000,000. Long-term credits have been extended by the Foster-Wheeler Corporation.

M. V. Barinov, president of the Azneft Oil Trust, who is now in this country, together with several of the leading engineers of the trust, participated in the negotiations resulting in the signing of the present agreement.

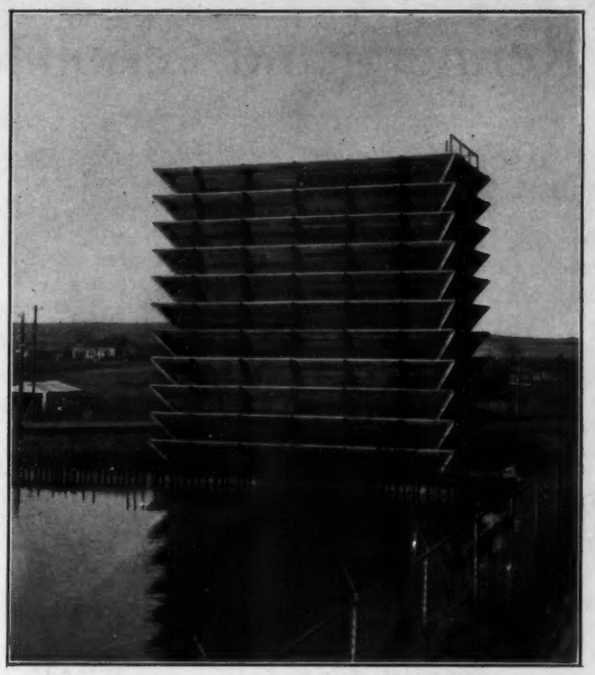
Announcement of this agreement was made June 10 by Saul G. Bren, chairman of the Amtorg Trading Corporation, and J. J. Brown, chairman of the Foster-Wheeler Corporation of New York.

Leeds & Northrum Company, 4901 Stanton Avenue, Philadelphia, has just secured 190,000 additional square feet of property, including approximately 85,000 square feet of additional floor space in a modern one-story building of saw-tooth roof construction, for the purpose of carrying out a program of immediate expansion.

The new building will be made integral with the present building by means of a connecting wing, construction of which has already started. The new arrangement will be ideally adapted to the company's manufacturing processes.

M. J. Gavin, refinery engineer of the U. S. Bureau of Mines, headquarters at San Francisco, has resigned to accept a position with the Foster Wheeler Corporation. Gavin was in the employ of the government for 11 years, during which time he prepared numerous bulletins and technical papers on oil refining subjects. He also had charge of the design, construction and operation of the government's oil shale plant at Rifle, Colorado. Gavin is in the New York office of the Foster Wheeler Corporation, but expects soon to return to California, where he will be in charge of the Los Angeles office of that company.

J. R. McDermet, who served the Elliott Company, Jeannette, Pennsylvania, for the last 12 years in such positions as research engineer and manager of the heater department, has been appointed chief engineer of that company. He is an electrical engineering graduate of Illinois University, class of 1916, and spent two years doing experimental work in engineering at the university following graduation. Later he was assistant professor at the University of Pittsburgh and a Fellow in the Mellon Institute.



One of our cooling towers installed at the Boynton, Oklahoma, plant of the Transcontinental Oil Company.

When Engineers Decide

IF THE selection of a cooling tower is left to the refinery engineers, they usually decide in favor of apparatus which they know will deliver definite guaranteed results.

For over 20 years we have been erecting and designing cooling towers and spray nozzle cooling systems for the leading refiners of the country. In each case, the problem presented to us has been successfully solved by our engineers to the entire satisfaction of the purchaser.

The most economical cooling tower you can buy will be the one which gives you the best cooling results; the tower which stands up longer and requires fewer repairs. We shall be glad to design and erect such equipment for you.

THE COOLING TOWER COMPANY, Inc.

15 JOHN STREET NEW YORK

Local Representatives:

Houston, Texas
The J. A. Rossiter Co.,
410 Union Nat'l Bank Building

Tulsa, Okla.,
N. M. Muir,
Kennedy Bldg.

Los Angeles, Calif.
N. O. Fleming Co.,
5815 Maywood Ave.,
Huntingdon Park

Representatives in Other Principal Cities

Announcement

W. J. Podbielniak and P. M. Raigorodsky

have opened offices in the
Philtower Building, Tulsa, Oklahoma,
Tel. 4-7258

Consulting Engineers

Natural Gasoline Plant Design and Operation
Analytical and Research Laboratories
Fractional Distillation Analysis

Refinery and Gasoline Plant Activities

OKLAHOMA GASOLINE PLANTS

Atlantic Oil Producing Company, Tulsa Trust Building, Tulsa, plans to build an oil absorption natural gasoline plant near Okemah, Oklahoma, at an estimated cost of $75,000.00.

P. Zobisch, Butler, Oklahoma, announces plans to start construction of natural gasoline plant at estimated cost of $100,000.

MidCo. Oil Corporation has about completed construction of its Oilton, Oklahoma, Type 75 Southwestern oil absorption natural gasoline plant.

Coline Oil Company has a type 75 Southwestern natural gasoline plant under construction at the Capital Field, Oklahoma City district, in the south half of the northwest of Section 24-11-3w.

Gypsy Oil Company is well along on its construction of a type 200 Southwestern oil absorption gasoline plant at Little River, Greater Seminole area.

J. E. Crosbie, Tulsa Oil producers and Martin and Porter have announced plans to build a 10,000-gallon capacity absorption natural gasoline plant in the Cary pool of Okfuskee County, Oklahoma.

TEXAS PANHANDLE CONSTRUCTION

Skelly Oil Company is installing two type 200 Southwestern natural gasoline plants on its Schaffer lease, near Borger.

Western Carbon Company, subsidiary of the Columbian Carbon Company, New York, plans additional construction at its carbon black plant near Borger, and also two additional units at its LeFors plant.

ColTexo Corporation is enlarging its natural gasoline plants Nos. 1, 2 and 3 near LeFors.

BOOSTER STATION

Magnolia Gas Company, Magnolia Building, Dallas, has acquired an 82-acre site near Beeville, Texas, upon which it will construct a gas booster station at an estimated cost of $100,000.

GYRO VAPOR PHASE CRACKING UNIT FOR ENGLAND

Petroleum Refineries, Ltd., will soon start construction of a Gyro Vapor Phase cracking unit. This is the first unit of this type to be constructed in Europe. Gyro process was developed by Pure Oil Company and is now in operation at Heath, Ohio, Muskogee, Oklahoma, Smiths' Bluff, Texas, and Cabin Creek, West Virginia, by this company. The English unit will be constructed on an 11-acre site which is paved with concrete, having formerly been used during the war as an air port. The location is at Killingholme, near Hull, England. The Petroleum Refineries, Ltd. was organized to process tar resulting from carbonization of coal by Low Temperature Carbonization Ltd.

Gyro Vapor phase process is being marketed by Max B. Miller company. At South Charleston, West Virginia the Carbide and Carbon Chemicals Corporation is operating a 1500-barrel unit of this type. McColl Frontenac in Canada is also operating Gyro units.

VAPOR RECOVERY PLANT

The Hancock Oil Company, operating a 12,000-barrel skimming plant at Signal Hill, (Long Beach field) California, is installing a new vapor recovery system of Southwestern design which will extract gasoline from tank and receiving house vapors.

NEW CORPUS CHRISTI REFINERY

It is reported that G. B. Eggleston & Company, Milan Building, San Antonio, is representing Globe Oil & Refining Company, Blackwell, Oklahoma, in the proposed refinery to be erected at Corpus Christi, Texas. Capacity of the proposed plant is given as 2500 barrels or better and to include two tube stills and conjunctive equipment. Cost is estimated at $200,000.

Producers and Refiners Corporation is constructing a new Winkler-Koch crude topping distillation unit at its West Tulsa refinery, which, it is reported, will have a rated capacity of 6000 barrels daily.

McKENSIE RIVER REFINERY

Hudson's Bay Company at Winnipeg, Canada, plans the construction this summer of a small refining plant at Fort Norman on the McKensie River. Capacity of this unit will be only sufficient to provide gasoline from the Fort Norman production for use of motor boats working in the northern rivers during the summer. Material will be carried to the site by boats from McMurry and Fort Smith. It is planned to have the plant operating before the close of the summer.

NASHVILLE PLANT RESUMES

Through a merging of operation entered into by six oil companies operating in and around Nashville, Tennessee, forming a new company under the name of Apex Oil Corporation, the shut-down refinery of 500 barrels capacity will resume operations.

Companies entering into the merger are, Benzol Oil & Gas Corporation, Cassette Oil & Grease Company, Frank Reed Oil Company, Thompson Oil Company, Estes-Cooper Oil Company and Southern Oil Service, Inc. John Lowe is president and Frank Reed, vice-president of the new Apex Oil Corporation. The new company will operate about 150 retail outlets.

INTEROCEAN REFINERY SOLD TO H. D. DINES

The skimming plant of the Interocean Refining Company which has been shut down for some time at McCook, Illinois, has been sold to H. D. Dines, a Chicago attorney at 310 South Michigan Avenue. Dines reports that he has no intention of operating the plant but will possibly dispose of it later.

GREASE COMPOUNDING PLANT

Merit Equipment Company, 6616 Morgan Avenue, Cleveland, has awarded contract to Truscon Steel Company, 4600 Euclid Avenue, Cleveland, for the construction of a one-story plant to be used for the manufacture of lubricants and grease.

INDIANAPOLIS PLANT

It is reported that Standard Oil Company of Indiana is having plans prepared for the construction of a petroleum refinery at Indianapolis, to cost $100,000.

COLD SETTLING PLANT

Gulf Refining Company, Frick Annex, Pittsburgh, has been preparing plant and estimates made for the construction of a cold settling lubricating oil plant to be built at its Girard Point, Philadelphia refinery, at an estimated cost of $150,000.

PURE OIL MANUFACTURES PAINTS

Pure Oil Company's new paint plant at Marcus Hook, has been placed in operation. Paints, varnishes, and similar protective coatings for use in the refining, marketing and producing branches of the petroleum industry will be manufactured at this plant. Rolling mills, ball mills, and pebble mills, were placed in operation late in May. The company has equipped its laboratory with all instruments for testing and checking familiar to the paint manufacturing trade. It is the intention of the company to study the needs of the various branches of the petroleum industry and to provide coating materials to meet existing conditions.

RIEDEMANN WITH CRYSTAL

Mr. J. H. Riedemann, who has been vice-president and general manager of the Gilliland Oil Company of New Mexico, for the past two years, has accepted a similar position with the Crystal Oil Refining Corporation, effective June 1. He succeeds F. W. Burford, recently resigned to devote his entire time to the Burford Oil Company, of which he is president.

Riedemann has been connected with the Gilliland organizations for past 10 years. From 1923 to 1927 he was in charge of natural gasoline plants, later going to New Mexico in charge of sales and refinery operations. Previous to his Gilliland connections he was with the Gypsy Oil Company in the natural gasoline department.

HOUSTON PLANT

Excellent progress is being made in the construction of the new Shell refinery at Houston. Indications are that the new plant will be ready to begin the production of gasoline and other products in early August.

The new refinery, which when completed will occupy more than 350 acres, has a daily capacity of 25,000 barrels and is advantageously located on the Houston Ship Channel, with a deep sea waterway from Houston to the Gulf of Mexico. It is of the most modern construction and its specially designed stills and other equipment are being installed for the purpose of refining Shell 400 "Extra Dry" and Super Shell gasoline.

Shell Petroleum Corporation owns its own producing wells, transportation facilities, refineries and marketing units. Other refineries are located at Wood River, Illinois, East Chicago, Indiana, Arkansas City, Kansas, New Orleans, Louisiana.

VAPOR PHASE PROCESS

Richfield Oil Company will start construction immediately of a vapor phase cracking process at its Hynes, California refinery.

KETTLEMAN HILLS ACTIVE

The Texas Company is completing installation of six more units to its absorption plant in Kettleman Hills, California. Two large compressors are being installed, also.

Standard Gasoline Company, a subsidiary of Standard Oil Company of California, will construct its second absorption plant at Kettleman Hills soon.

COSDEN NAME CHANGED

Acting on recommendations made by the board of directors, stockholders of Cosden & Company, Inc., which has extensive refining interests in the West Texas district and producing properties in Texas and Oklahoma, voted to change the name to Cosden Oil Company during a special meeting at New York May 14. The stockholders also authorized an increase in the common stock from 100,000 shares to 300,000 shares of no par value, and that three shares of the new stock be issued for each existing share. J. S. Cosden, a well known figure in Mid-Continent refining circles for years, and president of the company, was unable to attend the meeting because of illness at his home in Fort Worth.

Cosden & Company, Inc., was incorporated in February, 1928, with an authorized capital stock of $5,000,000 of seven per cent. cumulative preferred stock, divided into 50,000 shares of $100 par value, and also 100,000 shares of no par value common stock. Although the latter is not listed, it has jumped from about $50 to $175.00 per share within the past year, and the increased

MODERN PRACTICE

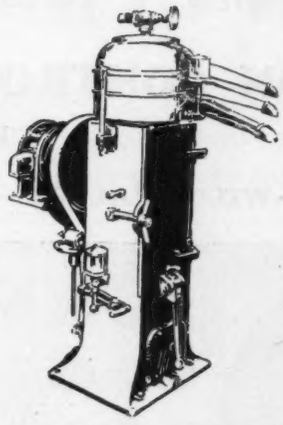
The Centrifuge

made possible by Refrigeration

WHEN refining was still in swaddling clothes petrolatum and bright stocks could be made only in winter, when the temperature was low enough to operate cold settling tanks.

Today artificial refrigeration enables the refiner to make those products the year 'round....in warm climate or cold.

Since 1882 this company has pioneered the machinery of refrigeration. The name "Vilter" is known to the entire world.



Vilter engineers are particularly well fitted to cope with refinery problems. Co-operation gladly extended to your engineeringstaff.

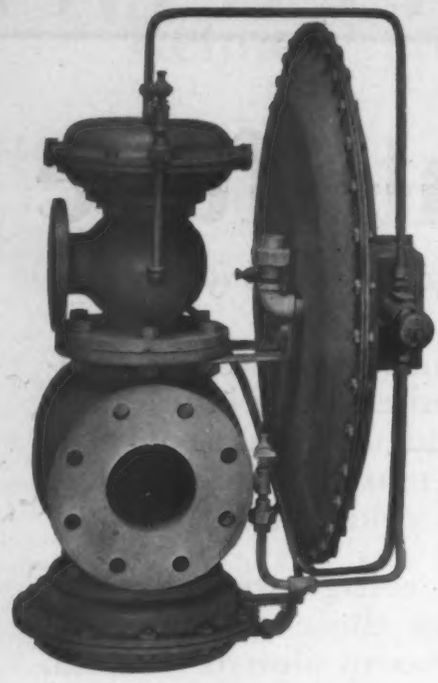
Write for Details

24-29

The VILTER MANUFACTURING Co.
1095 Clinton St.
MILWAUKEE WISCONSIN

COLOR
YOUR HIGH COMPRESSION
GASOLINE
A DISTINCTIVE COLOR
Write us for samples of colors you wish to try
INTERSTATE COLOR CO., Inc.
41 PARK ROW NEW YORK

WILCO VALVES



WILCO TANK CONTROL

Scores of installations in the California fields have proven this regulator.

The WILCO TANK CONTROL may be placed on the tank roof if desired, or it may be installed on the ground.

One regulator will operate equally well whether connected to one tank or to a group of tanks.

A WILCO TANK CONTROL will allow all the gasoline laden vapors to pass to the gathering line when gas is being generated and it will allow sufficient Dry gas to enter to prevent a vacuum being formed in the tank when gas volume shrinks.

ATMOSPHERIC pressure may be maintained or the regulator may be set to maintain slight pressure or slight vacuum.

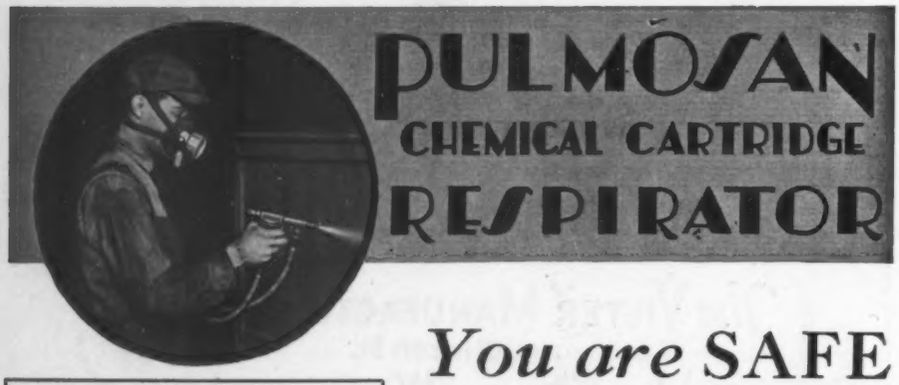
BUILT IN ALL SIZES OF CAST IRON OR STAINLESS STEEL TRIMMED.

SIMPLE-COMPACT-RUGGED
EXTREMELY SENSITIVE

WILKINSON CONTROLLER CO.

5700 SANTA FE AVE. LOS ANGELES, CALIF.

WILCO VALVES



You are SAFE

—in deadly, poisonous fumes, and *know you are safe* with the Pulmosan Chemical Cartridge Respirator.

This type (illustrated) received the *highest* rating for safety (99.7% efficient) by the National Safety Council Committee in an official test.

Other factors are improved features of comfort, and interchangeable parts which assure longer wear . . . . yet Pulmosans cost no more!

Complete details on request.

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SPARKS are DANGEROUS

Pulmosan AMPCO Non-Sparking tools will eliminate the fire hazard in your spray booths, cleaning rooms, tanks, tank cars, etc. . . . where inflammable fumes are a daily menace to life and property. Superior to brass or copper (will not squash or flake); practically as tough as steel! All styles. Write for circular.

number of shares was largely to permit more trading.

Cosden Oil Company has a skimming and cracking plant located near Big Spring, Texas, rated at 20,000 barrels daily, and is averaging about 12,000 barrels daily, although the cracking units will not be in service until July. The company is also interested in the Richardson Refining Company's plant, which is running about 5,000 barrels daily, pending completion of Jenkins cracking unit, and also in the Great West Refining Company's Skimming plant, which is running about 3,000 barrels of crude daily, although rated at 5,000 barrels or more in daily capacity. The latter two plants are on adjacent sites of the Cosden Oil Company's refinery. Wayne Rice is in charge of operation of the Cosden refinery. C. B. Faught is superintendent of the Richardson plant, and G L Rowsey is in charge of refinery operations for the Great West Refining Company.

Phillips Export Terminal

Phillips Petroleum Company of Bartlesville, Oklahoma, soon will begin construction on a gasoline refractionating plant on the Houston Ship Channel which will have a capacity of from 12,000 to 15,000 barrels per day. Immediate construction work will be devoted toward completion of a terminal on the site; facilities of the Crown Central Petroleum Company will be used until such construction is finished.

The site chosen for Phillips Petroleum Company's plant is a 50-acre tract, fronting 950 feet on the south side of the channel, adjacent to the Crown Central Petroleum Company's refinery on one side and near the plant of Horton & Horton. Rail facilities will be provided by the Public Belt Railway in order to take care of incoming equipment and raw materials, giving the plant both a water and rail terminus.

Material for construction of the plant has been ordered, and some of it, having already been shipped, is due in Houston in a few days. In addition to plant equipment proper, Phillips Petroleum Company has placed an order with the Chicago Bridge & Iron Works for immediate erection of an 80,000-barrel tank on the property. This tank will be shipped from Oklahoma. From the factory of the above concern, a 25,000-barrel tank will be shipped. Both tanks will be equipped with Wiggins breather roofs and will be used for storing natural gasoline stocks expected to accumulate here before the plant can be put into operation. Construction work will be under direction of F. E. Rice, general superintendent of the gasoline department of Phillips Petroleum Company.

Negotiations for the tract of ground were closed by M. T. Kirk and W. B. Lerch, special representatives of the Phillips organization.

Podbielniak-Raigorodsky Research Laboratory

Dr. Walter J. Podbeilniak and Paul M. Raigorodsky recently have formed a partnership to act as consulting engineers on the design and operation of natural gasoline plants and to organize an analytical and research laboratory for the analysis of gas, gasoline and absorption oils by fractional distillation and other tests.

Raigorodsky is well known to the industry through his connections with the Newton Process and the Engineering, Research and Equipment Company. Dr. Podbielniak is known through his development of successful methods of practical fractional distillation analysis for natural gas and gasoline and for his numerous articles on the practical application of such analysis to the design and control of gasoline plants. Their offices are located in the Philtower Building, Tulsa, Oklahoma, and the laboratories on the 12th floor of the Medical Arts Building.

The laboratories are being equipped with two Podbielniak double-unit apparatus for fractional distillation analysis of gas and gasoline samples, a Burrell Orsa-type apparatus for the standard absorption and combustion tests on gasses, equipment for the determination of gasoline content of lean and rich absorption oils, apparatus for the determination of molecular weights of oils by the freezing point method and other apparatus for running the standard tests of vapor pressure, A.S.T.M. distillation, and other functions.

The laboratory will render service in a number of ways: analysis of gas, gasoline and oil samples as outlined above; correlation of the analytical results such as calculation of specific gravity, heating value, molecular per cent., vapor pressure, distillation analysis and the approximate conversion of analytical results from one test to those from another in so far as this may be possible; calculation of plant material balances given the proper samples and plant operating data; and research work on problems for which it is equipped or may easily be equipped to handle.

An important problem in connection with the work of the laboratory is sampling and sample containers. The laboratory has prepared suitable designs for both gas and gasoline containers and will either rent or sell such containers at a small profit in order to standardize practice in this respect. Circulars will be issued from time to time on recommended sampling methods.

In order to give further service the laboratory has engaged an expert maker of scientific glass apparatus who is available to make glass apparatus of all kinds and to make repairs. This will be a convenience to numerous laboratories of petroleum companies in the Mid-Continent.

Aside from its commercial activities the laboratory will of course serve the partnership Podbielniak-Raigorodsky in their consulting work on the design and operation of natural gasoline plant and equipment, complete test on plants involving data for plant material balances, specification of equipment, etc.

Podbielniak will also continue to manu-

110% ON AN INVESTMENT

in one year is not a bad return. Yet several refiners who have invested in **NICHOLS HERRESHOFF FURNACES** for revivifying fullers earth have done better than this. We know of no better investment. Write us.

G. G. Brockway Company
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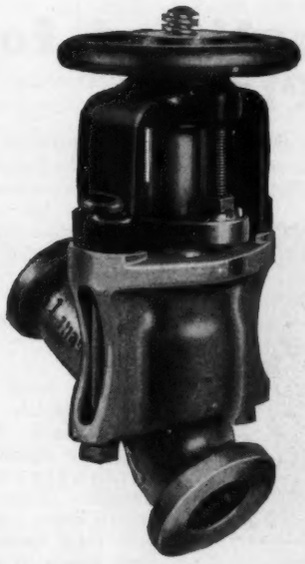
Duriron Y Valves
for acid lines

The Duriron Y Valve is, first of all, extremely resistant to the dual attack of corrosion and erosion encountered in the handling of refinery acid and sludge.



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This valve provides full opening and nearly straight flow; will not stick, and may be repacked under pressure when in a closed position.

Send us the attached coupon (no salesman will call unless you desire) and we will send complete information on this Y valve.

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Send us full information on the acid- and abrasion-proof Duriron Y Valve.

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Company.....

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A new Dixon Product that is backed by the reputation and resources of a company which has served industry for more than 100 years.

DIXON'S GRAPHITE SEAL—a graphite paste for sealing screw thread, flange and gasket joints that is unequalled in preventing leaks in joints of pipe lines carrying hot or cold oils, gasoline, creosote, tar, superheated steam, etc. It is also unequalled for gaskets of all kinds, plates, bolts, nuts, studs, etc.

Dixon's Graphite Seal expands when subjected to heat and makes leak-proof joints that hold tight under all conditions of service. Yet these joints may be easily opened at any time.

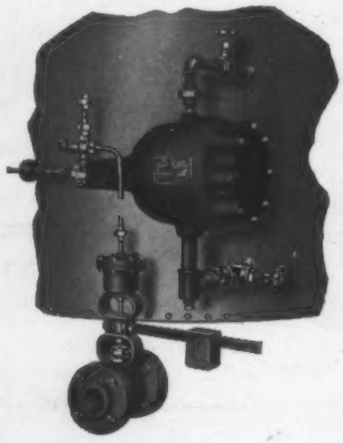
Let us tell you wherein Dixon's Graphite Seal differs from any other product you may have used for this purpose. Write for Circular DS-99 and full information.

JOSEPH DIXON CRUCIBLE CC.
Jersey City New Jersey
Established 1827

Thoroughly Qualified for Gasoline Plants

IN gasoline manufacture this *C-F* Back Pressure Regulator has made a reputation for proficiency in satisfying back pressure requirements. It will hold back any pressure from 300 to 800 pounds. At the same time it will either *continuously* or *intermittently* (depending upon which of two types is used) discharge the gas.

It can be used in the supply line to a distributing system having approximately atmospheric pressure or it can be used against a back pressure which is only slightly lower than the pressure to be controlled. In either of these cases the discharge is usually *continuous.*



It can be used also where auxiliary pressure for the operation of the regulator is desired. In this case the *intermittent* type is employed.

Let us send the bulletin which describes and illustrates the operation and construction features. There is sure to come a time when (and there are many places in your plant where) this fine *C-F* Regulator can be called into your service.

C-F Back Pressure Regulator

(Pilot Valve type for High Inlet Pressure)

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facture and distribute the Rodbielniak apparatus with fractional distillation of gas and gasoline.

Raigorodsky has organized the Mid-Continent Engineers, Inc., for the purpose of engaging in the general manufacture, sale and construction of gasoline plants and similar equipment.

* * *

D. M. Wolfe of the technical department of the Standard Gasoline Company, subsidiary of Standard Oil Company of California, with headquarters at Los Angeles, spent several weeks in June making a study of gas conditions in the Yates field, West Texas, where The California Company, another standard Oil Company of California subsidiary, has a large oil and gas production.

* * *

The Waggoner Refining Company has purchased a 10,000 barrel capacity Hortonsphere tank to be erected at its refinery west of Electra, Texas, to store natural gasoline from the company's absorption gasoline plant in a nearby field.

* * *

COMPLETE LINE

Bluebonnet Oil & Refining Company and Wickett Refining Company, which are affiliated concerns with skimming plants at Wickett, Texas, completed about June 15 a four-inch pipe line, extending from the above plants to the Shipley pool, in southeastern Ward County, a distance of about 15 miles. Contracts were made early in May with a group of producers in the Shipley pool to handle and purchase their oil for a period of three years. This oil averages 36 gravity, with about one per cent. sulphur content, and is being obtained at $1.05 per barrel at the well, as per contract terms, or 13 cents per barrel below the current gravity scale price of major companies in West Texas. The two Wickett plants will also continue to operate as heretofore on Winkler County crudes, which average 29 plus gravity.

* * *

Tank car shipments of crude from fields in the Mirando district to refineries at San Antonio and Somerset will be increased through the authorization on June 24, of a freight rate of 13 cents per 100 pounds on crude moving over the Texas-Mexican Railway from the following field loading points: Bruni, Laurel, Oilton and Mirando City.

* * *

The refineries being operated at El Paso, Texas, by the Rio Grande Oil Company, the Pasotex Petroleum Company and The Texas Company on West Texas crudes are now served with gas fuel through completion of the El Paso Natural Gas Company's 16-inch trunk line, which delivers gas from the Lea County, New Mexico, field on June 19.

* * *

Wichita, Kansas. — Phillips Petroleum Company, Bartlesville, Oklahoma, has purchased an 82-acre refinery site at Wichita.

A refinery at this point will be strategically located.

Federal Board Adopts New Gasoline Specifications

The Federal Specifications Board has adopted specifications for a new grade of gasoline for special purposes to be known as Motor Fuel V, and also made changes in the 10 per cent. point for U. S. government motor gasoline.

The changes have been the subject of conferences between the Federal Specification Board's technical committee on lubricants and liquid fuels and representatives of the petroleum industry since the technical committee on March 16 rejected many of the recommendations of the conference held by the American Petroleum Institute March 15. Directors of the Institute voted to protest the adoption by the Federal Specifications Board of the specifications proposed by the technical committee and appointed a committee under the chairmanship of J. Howard Pew, president of Sun Oil Company, to deal with this situation. The other members of the committee as originally appointed were R. C. Holmes, president of The Texas Company, and W. M. Irish, president of Atlantic Refining Company. Later the committee was revised to consist of the following members:

Chairman: J. Howard Pew, Sun Oil Company; E. S. Hall, Standard Oil Company of New Jersey; W. M. Irish, Atlantic Refining Company; E. W. Isom, Sinclair Refining Company; F. T. Klein, The Texas Company, and L. W. Parsons, Tide Water Oil Company.

Mr. Pew's committee succeeded first in having action by the Federal Specifications Board deferred until the June 11 meeting to give it time to make a study of the bearing of federal gasoline specifications upon state laws and to confer with Dr. Dickinson, chairman of the Federal Specification Board's technical committee on lubricants and liquid fuels and various petroleum technologists. After going into the question thoroughly both from the point of view of what the government departments desired to be able to buy and from the point of view of the effect upon the petroleum industry through the adoption of government specifications by states, a recommendation was made to the technical committee that a new gasoline specification be set up, to be called Motor Fuel M, differing from U. S. government motor gasoline in having the 10 per cent. point set at 158 degrees F. The technical committee did not accept this recommendation in its entirety, however, but provided for gasoline of increased starting volatility by a provision to lower the 10 per cent. point on U. S. motor gasoline either 9 or 18 degrees F. The new specifications and the revised U. S. motor specifications, in full, follow:

Master Specification No. 622a for Gasoline, Motor, United States Government

Revision promulgated June 11, 1929.

Supersedes part of U.S.G.M. Spec. No. 2d.

This specification was originally promulgated by the Federal Specifications Board on February 3, 1922, for the use of the departments and independent establishments of the government in the purchase of motor gasoline.

The technical requirements of this revision of this specification shall become mandatory for all departments and independent establishments of the government not later than September 11, 1929. They may be put into effect, however, at any earlier date, after promulgation.

1. This specification covers the grade of gasoline used by the United States government and its agencies as a fuel for automobile, truck, tractor, motor boat, and similar engines.

2. Gasoline purchased under this specification shall be described as "U. S. Government Motor Gasoline" with the understanding that this designation always refers to the current specification of the Federal Specifications Board.

3. The gasoline shall be free from water and suspended matter.

4. *Sampling.*—Samples shall be taken according to the procedures described in Part 3 of United States Government Master Specification No. 2d, or latest revision thereof.

5. *Corrosion Test.*—Method 530.22. A clean copper strip shall not show more than extremely slight discoloration when submerged in the gasoline for 3 hours at 122 degrees F.

6. *Distillation Range.*—Method 100.13. When 10 per cent. has been recovered in the receiver, the thermometer shall not read more than 80 degrees C. (176 degrees F.) nor less than 50 degrees C. (122 degrees F.); provided that, for each per cent distillation loss less than 4 per cent.,

The Campbell Engineering Co., Short Hills, N. J.

Manufacturers of the TAR BABY BURNER, to handle Fuel Oils, Water Gas Tar, Acid Sludge and Residue Fuels.

Without obligating us in any way, please send information on ( ) the Watermelon Type of Steam Control for Oil Stills; ( ) the Pumpkin Seed Type, ( ) the Tar Baby Oil Burner for burning residue and other fuels.

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Write for a list of leading refineries using the

CAMPBELL STEAM FLOW CONTROLLER

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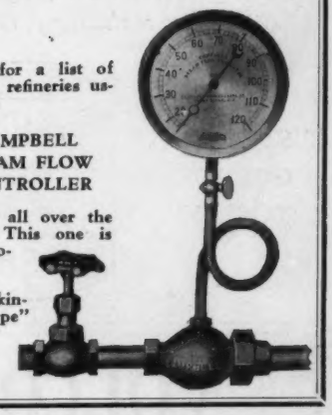

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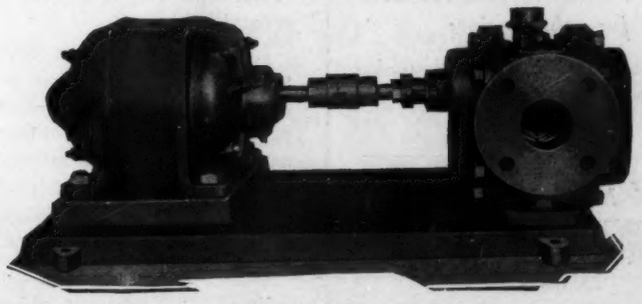
FOR OILS—light or heavy, hot or cold.



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WITHSTANDS

H_2S & H_2SO_4

and other corrosives met with in Refineries

THE ONLY PAINT TRIED, TESTED and USED EXTENSIVELY by the PRINCIPAL COMPANIES

Also for condensers, agitators, kettles, exchangers, etc.

STOP THAT CORROSION TO-DAY!

VOLCO

HOLZAPFEL'S HEATPROOF PROTECTIVE

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RED HEAT!

Use it on any surface too hot for other paints

Extensively used for hot smoke stacks, exhaust pipes, mufflers, etc.

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obtained in the A.S.T.M. distillation, the minimum of 10 per cent. temperature requirements shall be lowered 3 degrees C. (5.4 degrees F.). The government reserves the right by proper provision in the contract or purchase order* to lower maximum 10 per cent. point either 9 degrees F. or 18 degrees F. Administrative action in this respect may be taken by contracting officers to meet the temperature conditions under which the equipment must operate. (see Footnote 1).

When 50 per cent has been recovered in the receiver, the thermometer shall not read more than 140 degrees C. (284 degrees F.)

When 90 per cent has been recovered in the receiver, the thermometer shall not read more than 200 degrees C. (392 degrees F.)

The end point shall not be higher than 225 degrees C. (437 degrees F.)

At least 95 per cent shall be recovered as distillate in the receiver from the distillation.

7. *Sulphur.*—Method 520.11. Sulphur shall not exceed 0.10 per cent.

8. All tests shall be made according to the methods for testing contained in Part 2 of United States Government Master Specifications No. 2d (Bureau of Mines Technical Paper 323B), or latest revision thereof.

9. This specification supersedes that part of United States Government Master Specification No. 2d for Lubricants and Liquid Fuels, which covered United States Government Motor Gasoline.

Master Specifications No. 623 for Motor Fuel V.

This specification was officially promulgated by the Federal Specifications Board on June 11, 1929, for the use of the departments and independent establishments of the government in the purchase of Motor Fuel V.

The technical requirements of this specification shall become mandatory for all departments and independent establishments of the government not later than September 11, 1929. They may be put into effect, however, at any earlier date, after promulgation.

1. This specification covers a special grade of fuel which may be used by the government at the discretion of the head of the department or bureau concerned and its agencies, for ambulances, fire engines, emergency vehicles, military and naval equipment, and for other equipment under special conditions.

*Special attention is invited hereto.

NOTE 1: Contracting officers are advised that in general the expectation of freezing temperatures warrants the lowest maximum 10 per cent. temperature.

NOTE 2: When U. S. Government Motor Gasoline is to be used for some special purpose, such as that requiring tropical storage, the government reserves the right to raise the lower limit at the 10 per cent. point to not higher than 60 degrees C. (140 degrees F.) with the same corrections for distillation loss as given above. This limit, however, should not be applied unless absolutely necessary, since the gasoline so procured is less satisfactory for general purposes.

2. This fuel shall be free from water and suspended matter.

3. *Sampling.*—Samples shall be taken according to procedures described in Part 3 of United States Government Master Specification No. 2d, or latest revision thereof.

4. *Corrosion Test.*—Method 530.22. A clean copper strip shall not show more than extremely slight discoloration when submerged in the fuel for three hours at 122 degrees F.

5. *Distillation Range.*—Method 100.13. When 10 per cent. has been recovered in the receiver, the thermometer shall not

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MADE IN HOUSTON

Boiler Flanges
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HOUSTON, TEXAS

read more than 65 degrees C. (149 degrees F.), nor less than 50 degrees C. (122 degrees F.); provided that, for each per cent. distillation loss less than 4 per cent., obtained in the A.S.T.M. distillation, the minimum 10 per cent. temperature requirement shall be lowered 3 degrees C. (5.4 degrees F.).

When 50 per cent. has been recovered in the receiver, the thermometer shall not read more than 125 degrees C. (257 degrees F.).

When 90 per cent. has been recovered in the receiver, the thermometer shall not read more than 180 degrees C. (356 degrees F.)

The end point shall not be higher than 205 degrees C. (401 degrees F.).

At least 95 per cent. shall be recovered as distillate in the receiver from the distillation.

6. *Sulphur.*—Method 520.11. Sulphur shall not exceed 0.10 per cent.

7. All tests shall be made according to the methods of testing contained in Part 2 of United States Government Master Specification No. 2d, for Lubricants and Liquid Fuels (Bureau of Mines Technical Paper 323 B), or latest revision thereof.

California Association Names Officers

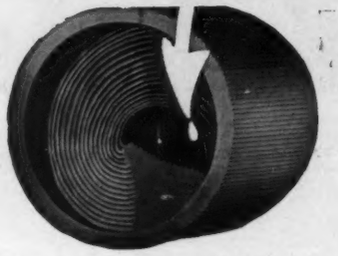
Los Angeles.—At the annual election of officers of the California Natural Gasoline Association, held here in connection with the regular monthly meeting, June 13, George L. Ratcliffe was re-elected president and R. E. Beckley was elected vice-president for the ensuing year. Ratcliffe, who is head of the natural gas department of the General Petroleum Corporation, is now serving his third term as president of the association. Beckley is connected with the Standard Gasoline Company, a subsidiary of the Standard Oil Company of California.

Sixteen directors to serve for two years were elected as follows: A. Bell, Marland Oil Company; A. H. Bradford, West Coast Oil and Refining Company; J. N. Hicks, Superior Oil Company; W. A. Kirk, U. S. Refining Company; H. R. Linhoff, Richfield Oil Company; S. F. Magor, Pacific Western Oil Company; H. E. Moulton, C. C. M. Oil Company; H. W. Parmelee, Lovell Gasoline Corporation; A. M. Porter, Shell Oil Company; F. N. Rumbley, Lovell Gasoline Corporation; W. D. Smith, Wilshire Oil Company; E. L. Tobias, Bankline Oil Company—Norwalk Company; C. J. von Vibra, U. S. Refining Company; J. S. Watson, Shell Oil Company, and O. Weaver, Barnsdall Oil Company.

Members of the delegation who attended the annual convention of the Natural Gasoline Association of America at Tulsa, May 21, 22 and 23, reported on the various papers read.

An hour of Big Time entertainment was furnished through the courtesy of the J. A. Campbell Company, J. B. Gill Corporation and Westcott and Greis, Inc.

The Spiral Motion Is the Trick



That's why Hood's Chemico Spiral Packing Rings have been selected by so many engineers. The center hole prevents choking and clogging.

Made of acid-resisting shale—practically indestructible.

Used by all big producers because of the intensive movements.

Samples on request

B. MIFFLIN HOOD CO., DAISY, TENN.

Only as Big as Your Hand *but the Most Efficient Steam Trap Known!*

Compared with old fashioned types of steam traps, the Sarco is so small that it hardly seems possible for it to keep lines free from condensate.

But the fact remains that over 450,000 of these traps are now doing the work of big traps that cost THREE times as much in a list of plants that in itself would comprise a fair-sized directory of America's leading industries.

The fact also remains that every one of these Sarco Steam Traps was sold entirely upon the basis of actual proof of efficiency in actual operation. The record of the fuel savings accomplished by Sarcos runs into enormous figures.

We have never asked anyone to accept our word that Sarco Steam Traps would do the same work as high-priced traps. Our policy always has been to let the user try the Sarco Traps in the steam line and make them prove themselves. The fact that these tests have sold almost a half million Sarcos should be sufficient inducement for you to put them to a similar trial.

Sarco Traps are self-adjusting for any steam pressure from 0 to 100 lbs.

30-DAY FREE TRIAL

We'll send you a Sarco Steam Trap on a 30-day free trial. Simply screw it into the line. No adjustments, platform or pit necessary. If it doesn't sell itself, return it at our expense and there will be no charge. Write for sample and Booklet S-230.

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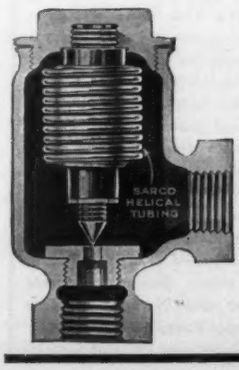

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Size ..... for pressure ..... lbs.

☐ Send Booklet No. S-230.

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